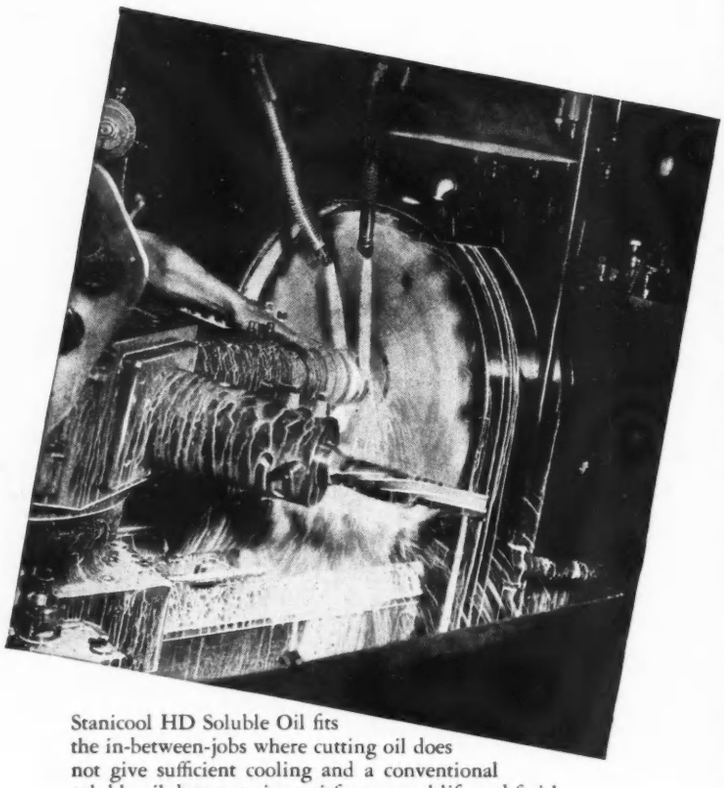
AUTOMOTIVE and Aviation INDUSTRIES

FEBRUARY 1, 1946

Eliminated a honing operation ...made job profitable



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AUTOMOTIVE and Aviation INDUSTRIES

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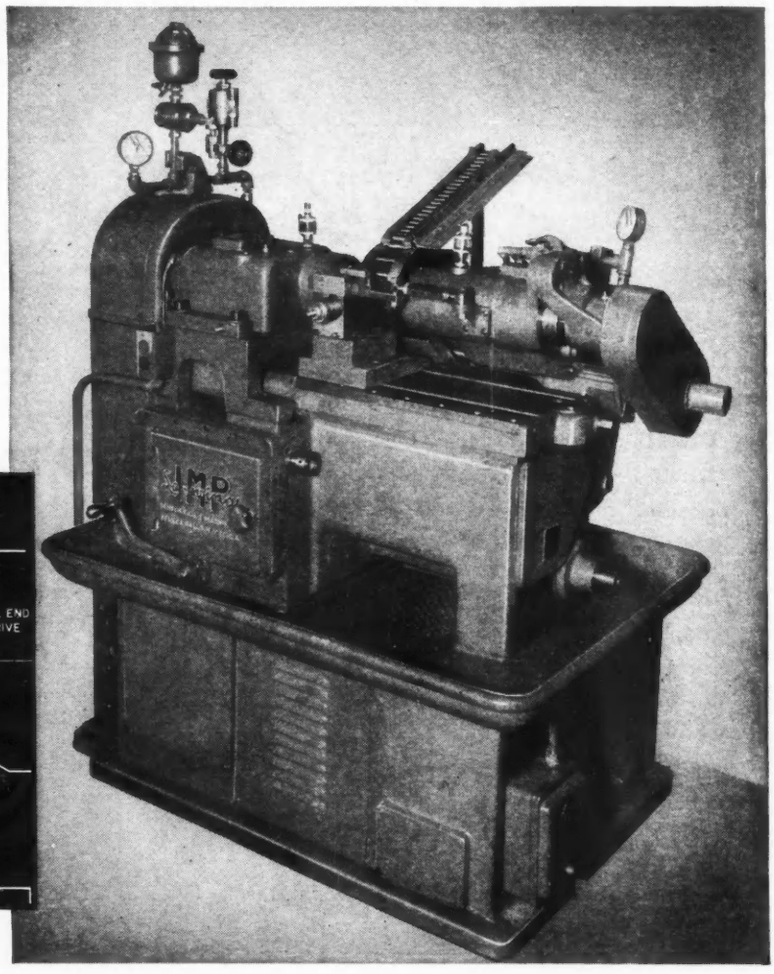
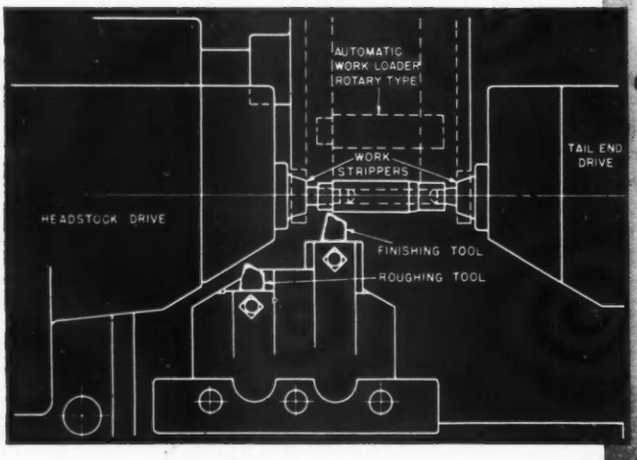
MACHINE OF THE MONTH

PREPARED BY THE SENECA FALLS MACHINE CO. **"THE Lo-swing PEOPLE"** SENECA FALLS, NEW YORK

Lo-swing Imp Lathe equipped with Automatic Rotary Loader and Double-End Drive.



Tooling layout for turning Valve Guides on Lathe illustrated at right.



AUTOMATICALLY LOADED Lo-swing IMP SLASHES COSTS ON VALVE GUIDE JOB

PROBLEM: To rough and finish turn valve guides in one operation with separate tools.

SOLUTION: The Lo-swing Imp Automatic Lathe was selected for this job and fitted with a new type Rotary loader and a complete new adaptation of tooling. This lathe is equipped with special revolving head and tailstock spindles driven from a splined jackshaft extending along the rear of the machine. The advantage of this double-end drive is two-fold; since the piece is driven from both ends much coarser carriage feeds are possible, thereby considerably increasing production; inasmuch as both spindles are driven, there is no wear on the revolving centers.

The machine is entirely automatic. Valve guides which have been previously bored to size are placed in a loading chute and fed by gravity into openings in the Rotary loader. The loader indexes the pieces to the proper position where they are automatically picked up by the continuously revolving spindles of both heads.

The O D is rough and finish turned in the same operation with two separate carbide tools, each having its individual feed. The finish turning tool begins cutting after the roughing tool has been relieved from the work, thereby assuring close concentricity between the bore and the finished diameter.

The Rotary type loader assures complete control over the fast revolving pieces eliminating danger to the operator and damage to the pieces which are completely stationary by the time they reach the discharge chute.

LATHE NEWS from SENECA FALLS

Who Should Pay Costs of Union Functions?

By Leonard Westrate

WITH industrial strife sweeping the nation, many thoughtful observers are giving the whole labor movement in this country a careful scrutiny. The power and influence of labor unions have risen precipitously during the last decade following passage of the Wagner Act. That is why it is well to examine what the ascendency of organized labor has done, among other things, to a very important phase of industry—production costs.

Before getting into the mechanics of how and why labor organization raises costs of doing business, it would be well to point out that responsible leaders in the automobile industry readily acknowledge that unions are a necessary part of the mass production technique and that they are here to stay. We want only to say we think it is high time someone called public attention to the fact that whatever the merit of labor gains, they must be paid for by someone and that there is much more involved than the specified hourly wage increases. Those are directly traceable and admit of accurate measurement. However, there are in addition, a multitude of related costs which are not readily pinned down, but which nevertheless are the direct result of the forces of labor organization. Like any other cost of production, these must be paid for in one of two ways—either by the ultimate consumer in higher prices, or by management through a narrowing of its profit margin. Traditionally, the consumer has paid. More recently, under price ceilings it has been management that has, and is, carrying the burden. It has long been apparent, too, that this latter method is the design of organized labor, particularly the UAW-CIO. In any event, the results are higher prices or reduced profits—or a loss.

Loss of productivity probably is the largest single hidden cost of doing business under labor unions. That productivity has declined is hardly debatable in view of the statement of R. J. Thomas, UAW-CIO president, in 1940, that the union had effected a decrease in productivity of about 10 per cent in the automobile industry. During the hearings before the Mead Committee, five years later, both management and labor admitted productivity was down, with estimates ranging from 15 to 50 per cent. Part of this latter reduction, of course, was due to war conditions, but since the return to peacetime operations, exactly the same as those prevailing before the war, productivity still is appallingly low. Henry Ford II, president of Ford Motor Co., and certainly a liberal industrialist in regard to labor, reported recently that productivity is down an *average* of 34 per cent. If that is an average, what must it be in some departments! Other companies report unofficially that they are about in the same situation. As a result, it is a safe assumption that labor costs are up about 30 to 35 per cent on the basis of low productivity alone, and if further wage increases are granted, as they surely will be, the figure might well go to 50 per cent on a unit basis. How serious this is can be seen from statements by C. E. Wilson, General Motors president, who said that in order for GM to restore the 1936-39 profit level it would have to not only recapture prewar worker efficiency, but also increase volume 60 per cent. Ford told the union that even if the company reaches maximum production this year, and if individual productivity increases 16 per cent, the company at present OPA ceilings will lose $27 per vehicle, or about $35 million per year.

Another cost attributable to union organization which can be measured only partially is the expense of carrying on the mechanics of collective bargaining. Chrysler Corp. reports that from April 6, 1937, to Dec. 3, 1944, it paid out $2,148,371.89 to employes representing the union for non-productive time spent in collective bargaining. Ford Motor Co. reports that in 1944 it spent $2,814,078.36 in the Dearborn area alone to collect dues and fees for the union and paid more than 1000 union men in the plants who spent all or part of their time handling union business. In both cases, however, no accounting is made of the time spent

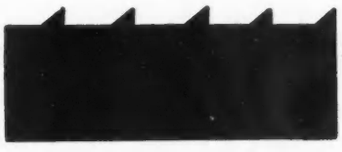
(*Turn to page* 92, *please*)

High

Table 1—Saw Control Factors for High Velocity Band Sawing of Plywood, Non-Ferrous Metals and Plastics

MATERIALS	SAW PITCH — Work Thickness (in.)				SAW VELOCITY — Work Thickness (in.)			
	½"	2"	4"	6"	½"	2"	4"	6"
PLYWOOD								
Weldwood, Pregwood, Douglas Fir, Menglebord	6	4	3	2	4400	4100	4000	3700
ALUMINUM ALLOYS								
Dural, 17 ST, 24 ST	4	3	3	2	3500	3000	2800	2800
Dural, 14 ST, Forgings	4	3	3	2	2800	2200	1800	1500
Cast, General	4	3	3	2	3500	3000	2800	2600
OTHER METALS and ALLOYS								
Babbitt	4	3	2	2	4000	2800	1800	1500
Lead, Brass, Copper, Zinc	6	4	3	3	1500	1500	1500	1500
Magnesium, Kirkalte	4	3	2	2	3800	3500	3000	2800
MISCELLANEOUS								
Asbestos	4	4	3	2	1500	1500	1500	1500
Brake Lining	6	4	4	3	1500	1500	1500	1500
Paper	6	4	4	3	1500	1500	1500	1500
Paper (Laminate)	6	4	3	2	2400	2100	2000	2000
Carbon	4	3	2	2	4000	3500	3000	3000
Rubber (Hard)	6	4	3	2	4000	3800	3000	3000
Rubber (Sponge)	6	6	6	4	4500	4000	3800	3000
Hair (Rubberized)	6	6	6	6	4500	4000	3500	3000
Sisal (Rubberized)	6	6	6	6	4500	4000	3500	3000
PLASTICS								
Methyl Metacrylate (No Fillers): Plexiglas, Lucite	6	4	3	2	3600	2800	2500	2300
Cellulose Acetate and Butyrate (No Filler): Vakelite, Herculoid, Fibestos, Lumarith, Nixonite, Plastacele, Tenite—I, Tenite—II	6	4	3	2	4200	3700	3500	3000
Phenolic (Cast) (No Filler): Bakelite, Catalin, Marblette, Baker Resin, Gemstone, Opalon	6	4	4	3	4600	4000	3500	3000
Phenolic (Laminate)—Paper—Canvas Base: Farlite, Formica, Insurok, Lamicoid, Micarta, Panelyte, Phenolite, Textelite	6	4	4	3	4500	4300	4000	3500
Phenolic (Laminate)—Glass Fabric and Asbestos Fillers: Farlite, Formica, Insurok, Lamicoid, Micarta, Panelyte, Phenolite, Textelite	6	4	4	3	3900	3400	2800	2500
Phenolic (Molding)—Macerated Fabric Sisal—Felt: Bakelite, Gemstone, Catalin, Marblette, Opalon, Prystal	6	4	4	2	3000	2500	1800	1800
Urea (Molding—No Filler): Bakelite, Cibanoid, Beetle, Plaskon, Uformite	6	4	3	3	4700	4500	4200	4000
Vinyl Resin (No Filler): Butacite, Saflex—TS, Butvar, Saflex, Vinylite—X	6	4	3	2	4700	4500	4200	4000

Using the full capacity height of a high speed contour sawing machine to remove excess material from magnesium casting. Improved saws and higher velocities have also simplified the removal of gates and risers by accelerating this operation tremendously.



Recommendations apply to this type of saw only.
Widths ¼ in.—½ in.—¾ in.—1 in.
Pitch 4-6; 3-4; 3; 2

Velocity Band Sawing

A Wartime Development That Can Be Applied to Peacetime Production

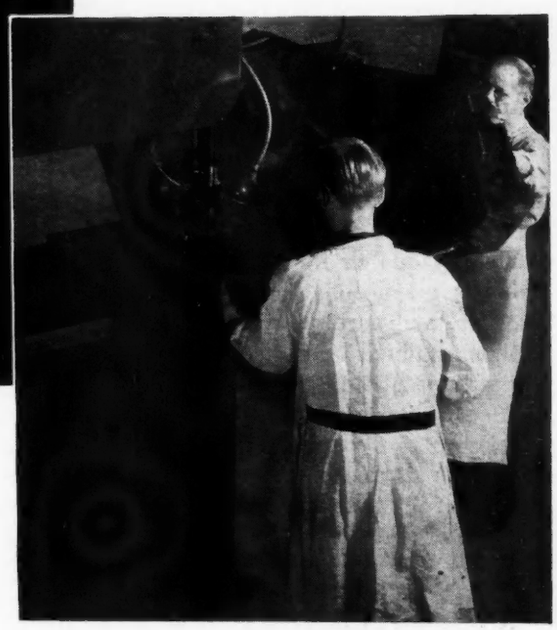
By H. J. Chamberland

FORTUNATE indeed is the manufacturer who can boast of the fact that he can just about forget his reconversion problems, because previous to Pearl Harbor he was making wood crates for John Doe and kept right on making them for Uncle Sam. However, this manufacturer discovered that during the last year of the war at least he had to accelerate his production to meet new delivery schedules. An innovation that helped greatly to make this increased production possible was improved wood cutting methods.

On the other hand, let's consider the operator whose prewar products involved a substantial amount of band sawing on a particular material or various types of materials, but whose war production was along entirely different lines of fabricating. If this executive has not kept himself well informed as to current events relating to his regular line of business, he has much to learn about what has happened during the war to revolutionize band sawing practice.

The aircraft industry benefited particularly by the introduction of the high velocity band sawing technique, due to the many types of materials going into plane production. The automotive industry also realized to no minor extent the advantages of the improved process, for full conversion to war production brought into the picture the cutting of practically all known materials.

The high velocity technique was not an overnight discovery, but the result of extensive re-



(Above)—Friction sawing is being used here to speed the cutting of this odd-shaped part at an aircraft plant.

(Right)—Friction cutting a bus fender with 10-pitch standard band operating at 4000 fpm.

search to verify the assumption that conventional saw velocities as applied to many materials had become quite obsolete. Once the fact had been definitely established that substantially higher saw speeds meant unprecedented cutting rates, improved finish and precision of cut and longer saw life, it was no problem for manufacturers of contour sawing machines to make the outcome of these tests realistic industrially.

The truth is, experience along these lines dated back some 10 years, which materially helped to simplify the new venture, or the designing of similar equipment but with increased strength and power for handling as much as 10 times greater saw speeds. In other words, the high speed contour sawing machine takes over where the conventional type leaves off, to cut materials which heretofore have simply handicapped the productivity of the latter equipment.

Since we now have available a wide range of speeds from 50 fpm to 15,000 fpm we may now band saw most efficiently more than 125 different materials rather than just "band saw" them as previously. In other words, band saw practice may now be approached from three distinct angles by selecting the proper machine and giving it the support of the correct saw blade in each case.

Primarily, standard contour sawing machines and the conventional speed range will no doubt prevail for a long time to cut the thicker ferrous metals and certain materials not for the present, at least, classed as high velocity applications. Things, however, happen fast these days and day-to-day reclassification is not unusual.

Now, stepping into high speed sawing and in fact super-high speed performance, we have a choice of machines each incorporating a particular variable speed unit with a speed range based on individual requirements. A 16-in. throat capacity unit, for example, is receiving wide acceptance in the woodworking and plastic fields, but it is of course adapted to cutting any material that will respond efficiently to velocities of from 1000 to 5000 fpm.

A considerably larger machine, with a 36-in. throat and 20-in. height capacity, provides a maximum velocity of 15,000 fpm and is justly called an all-purpose band saw due to its extreme versatility. This machine is responsible for revolutionizing band sawing practice, and particularly for creating the prevailing enthusiasm in friction sawing and its advantages in so far as present limitations are concerned.

Also available is similar heavy type equipment to accelerate the contouring of duplicate parts with a maximum degree of precise reproduction. This machine is fully automatic and for the first time applies the master-former principle to contour sawing practice.

Types of Saw Bands

A machine is only as good as its cutting tool and in this case we mean saw bands. Primarily, it is well to bear in mind that as a chip production tool a saw band is in a class by itself because its material waste is limited to a narrow kerf. This economy angle is however secondary to selecting the proper type of blade for each and every application.

Industry now has a choice of three distinct types of blading; namely, the standard pitch, the lately developed unique course pitch, both hardened tooth saws, and the spring tempered type of band. All three are adapted to high velocity sawing, but the maximum efficiency of each is governed by its use at the proper time and in the proper place.

Table 2—Saw Control Factors for High Velocity Band Sawing of Steels and Cast Irons

STEELS—S.A.E.	SAW VELOCITY Thickness 1/16"-1/8"	Thickness 1/8"-1/4"	Thickness 1/4"-1/2"	SAW PITCH Thickness 1/16"-1/8"	Thickness 1/8"-1/4"	Thickness 1/4"-1/2"
Carbon Steel 1010–1095	3,000	5,000	12,000	18	14	10
Manganese Steel T1330–1350	3,000	5,000	12,000	18	14	10
Free Machining X1112–X1340	3,000	5,000	12,000	18	14	10
Nickel Steels 2015–2515	3,000	6,000	13,000	18	14	10
Nickel Chromium 3115–3415	3,000	6,000	13,000	18	14	10
Molybdenum Steel 4023–4820	3,000	6,000	13,000	18	14	10
Chromium Steels 5120–5150	3,000	6,000	12,000	18	14	10
Chromium Steels 51210–52100	5,000	10,000	14,000	18	14	10
Chromium Vanadium 6115–6195	5,000	12,000	15,000	18	14	10
Tungsten Steel 7260–71360	5,000	12,000	15,000	18	14	10
N. E. Steels 8024–8949	5,000	12,000	15,000	18	14	10
Silicon Manganese 9255–9260	5,000	12,000	15,000	18	14	10
OTHER STEELS						
Armor Plate	3,000	9,000	13,000	18	14	10
Stainless Steel 18–8	3,000	9,000	14,000	18	14	10
Illium	4,000	12,000	15,000	18	14	10
Cast Steel	3,000	9,000	12,000	18	14	10
CAST IRONS						
Gray Cast Iron	3,000	5,000	7,000	18	14	10
Malleable Cast Iron	3,000	5,000	7,000	18	14	10
Meehanite Castings	3,000	5,000	7,000	18	14	10

Friction sawing should be attempted only with precision standard pitch bands

Either type of hardened tooth saw does not rob the spring tempered saw of its value; since it is not an all-purpose saw it proves efficient only in so far as it is used to cut materials within its intended field of applications. Only by comparative test with a hardened tooth band can the practicability of a spring tempered band be determined for a particular job. The original cost of a hardened band is also the last, whereas with the spring tempered band the original cost is negligible in comparison to its actual cost. The amount of square or linear inches each saw will cut of a certain material until both saws are exhausted, and the relative total production costs, tell the story.

The unique course-pitch saw band, identified by various trade names, was particularly designed for the

Plastics heretofore disintegrating, chipping or otherwise requiring a subsequent finishing operation are now band sawed most efficiently by using the proper saw control factor made possible by the high velocity technique.

high speed sawing of all kinds of wood, builders' board, the plastics in general, many types of other non-metals such as rubber and asbestos and, no less, the light metals. This saw has numerous advantages over its standard pitch ally, when and if it can be used, and that is often as shown in Table I.

The prime objective of this new saw is to provide a choice of course pitches for narrow bands, such as ½ in. and ¼ in., without sacrificing band strength. The wide tooth spacing has the effect of a standard pitch saw with every other tooth cut square. This compensates for an imaginary, but impractical, longer tooth resulting from a standard tooth shape of coarse pitch cut into a relatively narrow band. It is thus possible with this innovation, for example, to provide a ¼-in. band with 4 or 6 widely spaced teeth per in., whereas the standard ¼-in. band has a minimum of 10 teeth per in. to preserve band strength.

It is obvious that this improved saw will not lead even while cutting the greater heights, because chips do not wedge into the gullets to slow up cutting action and thereby generate excessive heat. Such a saw incorporates maximum tooth rigidity, tensile strength, guiding width and minimum stress concentration.

We must still make use of the standard band. In its various widths and pitches, it predominates for most applications coming under the heading of tool work, or cutting or shaping most alloy steels over ½ in. thick. In these instances we refer to the conventional velocity range. Standard bands of medium pitch are not only a first choice, but are imperative for friction sawing all steel alloys and some ferrous castings when they lend themselves to a work thickness limitation of the process. The saws also apply to cutting plastics of an abrasive nature, such as the Fiberglas laminates, to obtain satisfactory cutting rates and desirable finish consistent with saw life by means of a combination of conventional and friction sawing.

Materials and Their Saw Control Factor

Standard practice demands that the widest saw possible be used at all times, and this is doubly important with high speed sawing for maximum saw strength, rigidity and feeding pressure. Before sawing, it should be ascertained that a weld has been expertly executed, for a band will seldom break at a joint properly butt-welded.

A ½ in.-0.042 in. Raker set saw of correct pitch is most commonly used because this width is substantial for general purposes. Of course when contour sawing, the width of saw is consistent with the radius or irregular shape involved. Wider saws are also used, particularly for straight sawing, when substantial work pressure is applied.

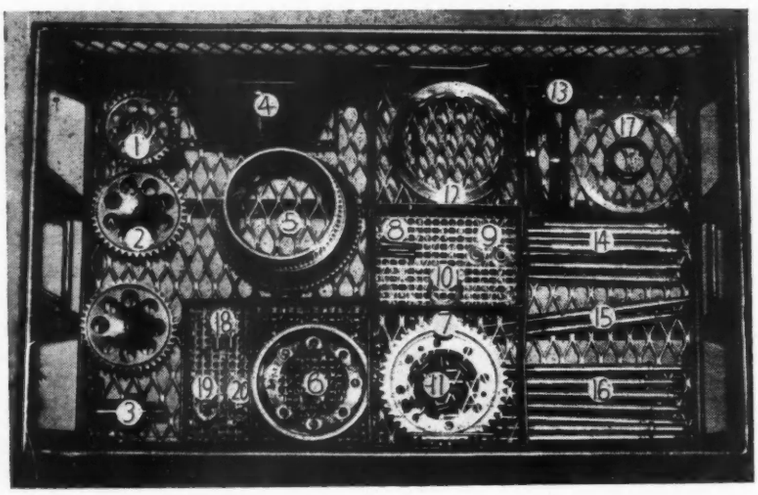
As related to wood and plastics, the high velocity band sawing technique has practically antiquated the conventional procedure. These materials, barring a

(*Turn to page* 58, *please*)

Table 3—High Velocity Band Sawing Rates on Materials in Aircraft Production

Material	Cutting Rate (linear inches per minute unless otherwise noted)
SAE 1095 steel—.088 thick (stacked 10 high)	112
¼ in. Non-magnetic steel	40
½ in. Specially treated steel	35
Chromium-Molybdenum tubing 2½ in. OD ⅜₁₆ in. wall	12 (lengthwise through flash weld)
Stainless steel-type 304 (18-8) (½ in thick)	5 (radius sawing)
Stainless steel (18-8) (.032 in. thick)	396
Stainless steel—18 gage (78 Rockwell C)	240
Seamless steel pipe (4½ in. diameter—¼ in. wall)	1.05 minutes per cut
Stainless steel tubing (1½ in. diameter—³⁄₆₄ in. wall)	30 cuts per minute
Copper—⅜ in. thick	100
Brass tubing (½ in. OD—.390 in. ID)	600 pieces per minute
Laminated Fiberglas (⅛ in. thick)	163
Bakelite—¼ in. thick	40
Lucite—¼ in. thick	48

Mass

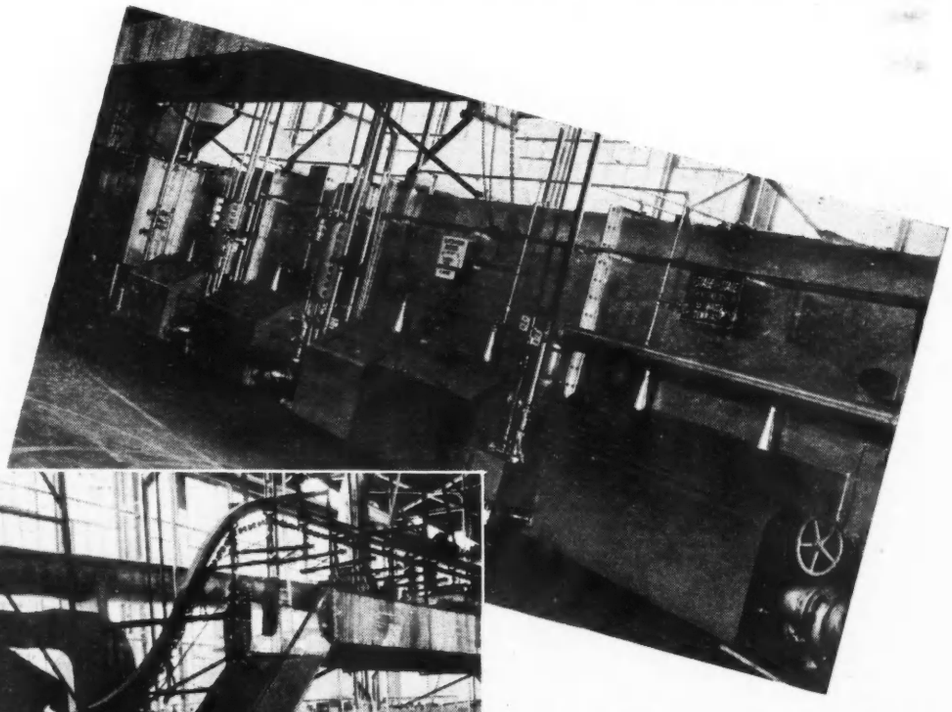


Small parts are placed in wire conveyor baskets, according to a prescribed pattern, as engines are disassembled to go through the automatic cleaning system. Baskets are tagged with metal tags identifying the parts with the particular engine from which they were removed.

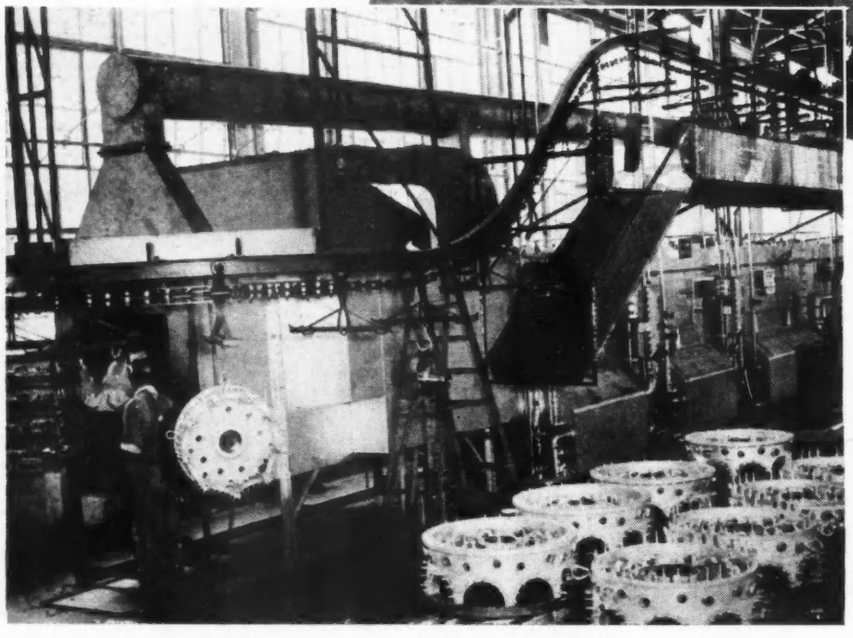
SEVEN major units make up the production line of the engine repair section at Warner Robins Air Technical Service Command in Georgia. During wartime operation this overhaul base turned out as many as 630 reconditioned R-2800 Pratt and Whitney twin-row, radial aircraft engines per month. Peacetime production is 300 engines per month and is confined exclusively to a single type—the R-2800 engine.

Used engines enter the production line in the Disassembly and Cleaning Unit, where they are completely dismantled and cleaned; pass from there to the Cylinder and Valve Unit and to the Parts Inspection Unit on conveyors; then to the Parts Repair and to the Stock Pool on

By
Alvin M.
Whitmer
Warner Robins Air
Technical Service Command



(Right)—Five-stage industrial spray washers in the disassembly and cleaning unit.



(Left)—Emerging from the five-stage washer and hot air dryer, small parts in wire baskets, cylinders and parts of engine power sections move on the conveyor to the assembly line. The automatic conveyor cleaning system cuts engine cleaning time in half. Six or seven employees operate the entire line, which includes 400 ft. of industrial spray washers and soak tanks and a 1100-ft. conveyor. Spray pressure is maintained at 90 psi and temperature of the spray solutions at 150 F or more.

Production *Methods Applied to* Aircraft Engine Overhaul

trucks; and lastly to the Subassembly for the build-up, and to the Final Assembly for completion.

A receiving and mounting stand starts the engine on the tear-down line in Disassembly and Cleaning, where 20 operations are required to complete the tear-down of the engine. These consist of the removal of accessories, cylinders, nose section, power section, and rear section. The subassemblies are then disassembled and the parts loaded into wire baskets, according to a prescribed pattern. Each engine requires 25 baskets with wire holders for parts too small to go on the conveyor as individual pieces. Baskets are tagged with metal tags to identify the parts with the engine from which they were removed.

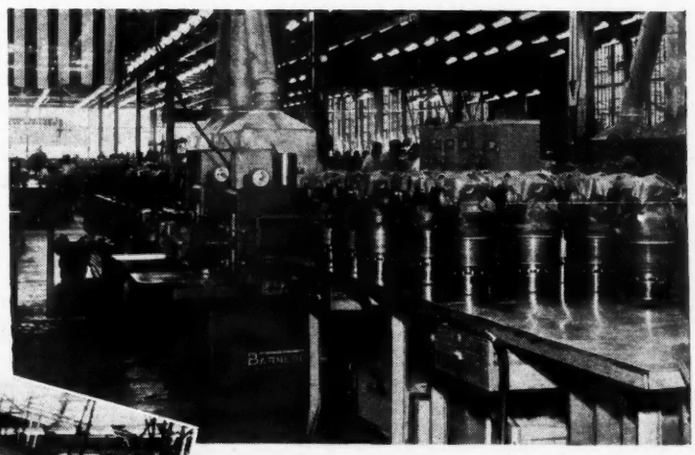
The parts and baskets are loaded on an overhead conveyor for cleaning. The automatic conveyor system is 1100 ft in length, counting turns and laps, and the tanks and washers cover a section 400 ft long. In the cleaning process, the parts first pass through soak tanks, then through the multiple stage washers and finally out for hand cleaning and buffing. By use of an overhead chain-type conveyor, the cleaning system has been credited with elimination of one of the most disagreeable aspects of large scale engine repair, thus breaking a big-scale bottleneck in production and relieving an acute labor shortage. It has permitted a more uniform processing of parts at a predictable rate of speed which was not possible with previous methods. Cleaning time for engines has been cut in half.

Cylinders, valves, engine cases, gears and remaining parts of the engine were formerly cleaned by being lowered into their respective tanks by means of monorail hoists and afterwards further cleaned by hand. With the conveyor system, once the parts are on the conveyor, they are untouched by human hands until they emerge from the opposite end. The process takes approximately three hours, reduces hand cleaning to a minimum and requires only six or seven employes.

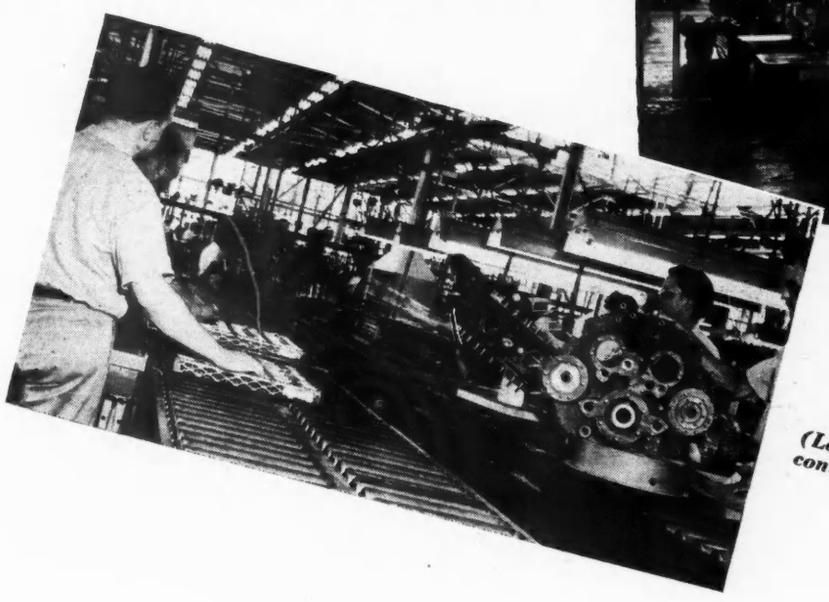
Aside from the conveyor, principal parts of the system are three large metal-covered tanks with a combined capacity of 28,660 gal and three industrial spray washers. Steam-heated coils maintain the tank solution temperature at 180 F. One washer is a single stage, another a two-stage and the third, a five-stage (see illustration). High powered sprays of alkali solution under 90 psi pressure flush off external grease and dirt.

Leaving the washers, the engine parts are fed into Parts Inspection Unit on two double lines and two single lines of table roller conveyors. A visual inspection of the entire engine is made as the parts traverse the lines. The double lines of roller conveyors carry the power section; crankcases and their parts traveling

(Text continued on page 26. Floor and flow plan on next two pages)

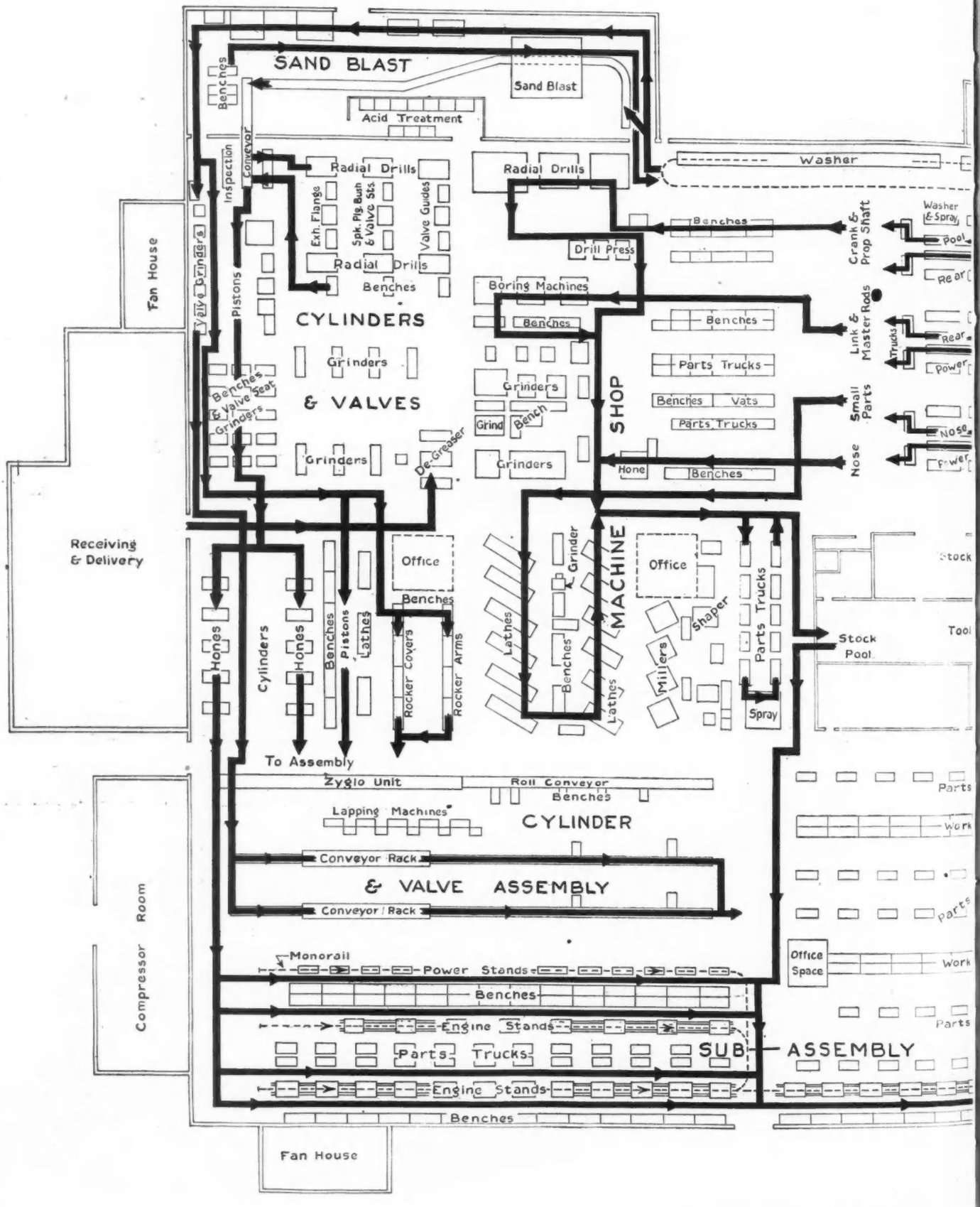


(Above)—Cylinder and piston assembly unit in the Cylinder and Valve department. Lapping machines are shown in the foreground.



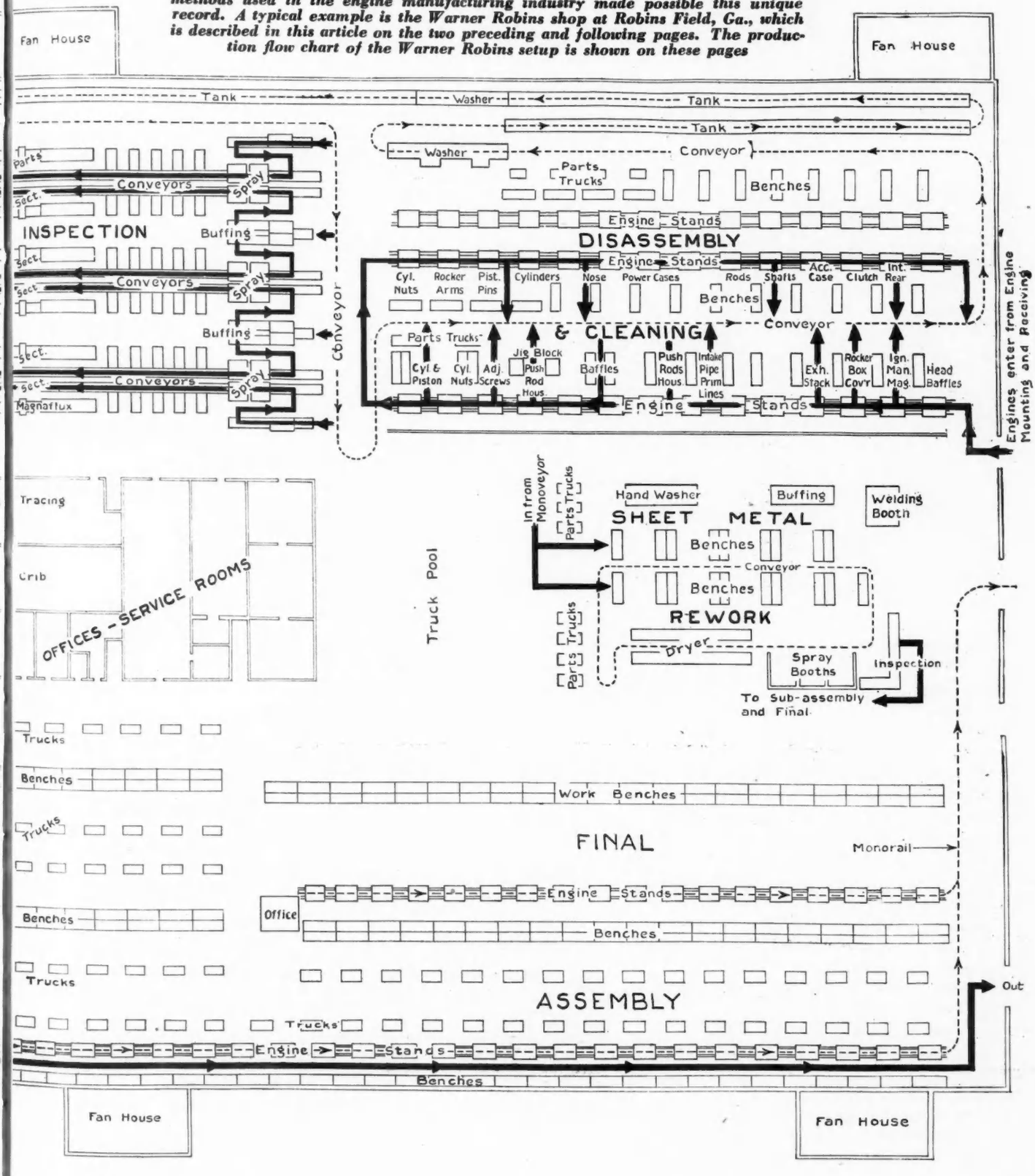
(Left)—Two of the double lines of roller conveyor systems in the Parts Inspection unit.

Flow Chart of Warner



Robins Production

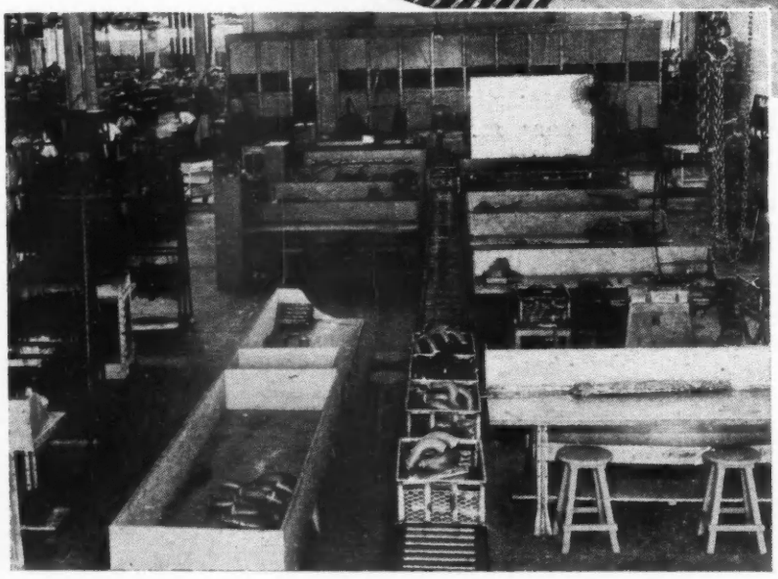
In the continental United States the Air Technical Service Command operates 12 maintenance stations, all of which have engine repair shops. Output at these shops reached a peak during October, 1944, when 11,151 aircraft engines were repaired, modified, or given major overhauls during that month. The San Antonio unit, largest of the shops, turned out 1389 engines in that period and the second largest shop, at Fairfield, Ohio, 1301 engines. Adoption of mass production methods used in the engine manufacturing industry made possible this unique record. A typical example is the Warner Robins shop at Robins Field, Ga., which is described in this article on the two preceding and following pages. The production flow chart of the Warner Robins setup is shown on these pages



Lathes, grinders, shapers, and drills which make up the machine shop unit.

the second the crankshaft assembly and the third the crankshaft gears, roller pins, front and rear counterbalances and cams. The fourth operation inspects the small gear train, the fifth handles the power case assembly and support, and the sixth, the master rod.

Each inspection line is equipped with a Magnaflux and demagnetizing coil, the final operations in this unit, after which parts go to spray washing booths. Defective parts are tagged by the inspector either as reparable or condemned. Replacements for the condemned parts are ordered on the check list, which accompanies the disassembled engine and may be filled by the stock tracer anytime while the engine is enroute to Subassembly. The condemned parts are removed from the line to a depository and



Miscellaneous Repair unit of the Parts Repair department. Exhaust stacks and deflectors are shown in parts baskets on the roller conveyor. Racks of newly painted deflectors are on the left.

on one and the blower section, or rear part, on the other. The nose section travels on one of the single lines, while pooled parts in wire baskets go through on the remaining single line just as they were sorted and loaded on the conveyor in Disassembly and Cleaning. They include brackets, oil lines, rocker shafts and rocker arms, engine mounting brackets and valve washers.

Complete inspection of the power sections is divided into 16 operations on each double line with an inspector for each operation. The number of operations is controlled by the number of engines scheduled for overhaul. The single line conveyors have six operations for the nose section and five for the pooled-parts line. With the present volume of production, the number of operations are held down to less than half those required for wartime production, according to WRATSC engine men.

Power section parts, like the nose section, are divided for inspection among the various operations, the first station handling cam rollers and silver-lead bearings.

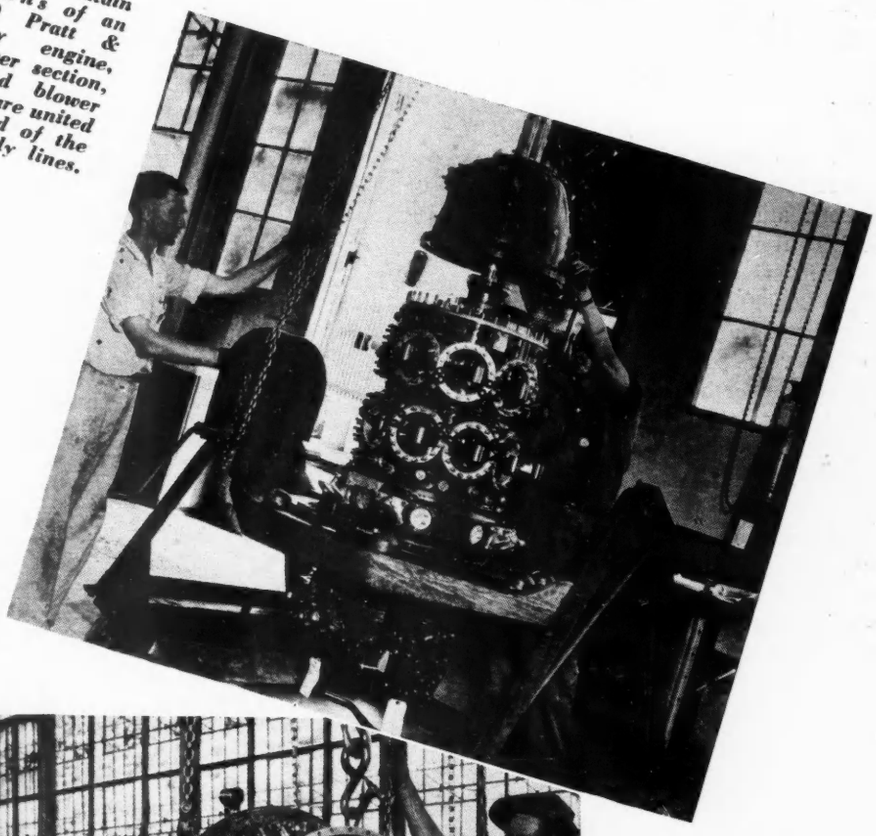
Assembling a reduction gear and propeller shaft in the nose section build-up in the Subassembly unit.

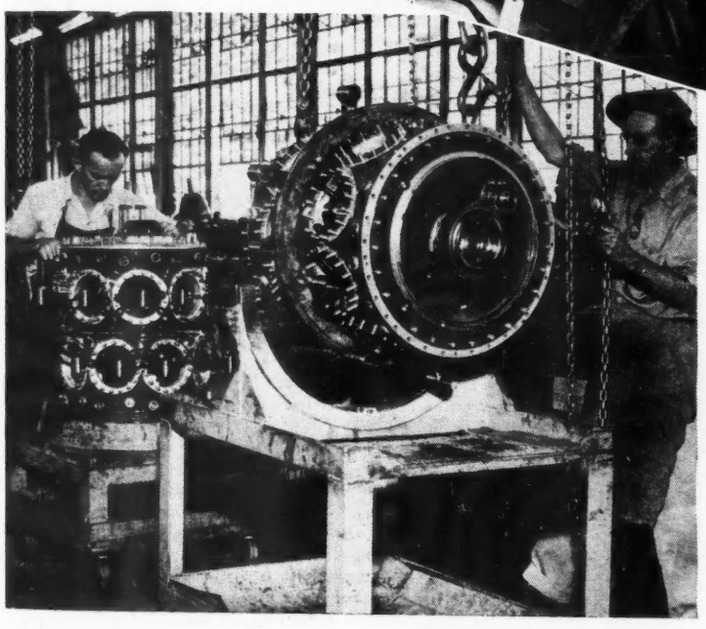
routed to Salvage, while parts tagged reparable go on to Parts Repair unit to be reworked. Inspection maintains a record of all condemned parts and the reasons, to be filed with a Disassembly Inspection report which is made on every engine. Parts which have passed all visual inspections and the Magnaflux, are demagnetized at the end of the lines, taken off and loaded into trucks for the Parts Repair unit.

The trucks, with bins and racks to accommodate the various parts, take them to the Parts Repair Unit which is divided into four sub units—one for reworking parts designated by inspection, the machine shop, sheet metal, and paint units. This unit, located immediately following Parts Inspection, has three lines of trucks for moving the engine nose, power and rear sections. The machine shop adjoins the lines on one side and the end.

Power section operations include the installation of bearings, checking clearances and reaming cam-follower guides. Technical Order compliance is accomplished on all three lines. All crankshafts are polished and the link rods and master rods bored. On the nose section line, propeller shafts are polished and the cases checked. The blower section line replaces bushings, accomplishes technical order work on the rear case and intermediate case, and reworks items designated by inspection. From Parts Repair the trucks are routed to the Stock Pool.

The three main sections of an R-2800 Pratt & Whitney engine, the power section, nose and blower sections, are united at the end of the Subassembly lines.





Removal of power section from special assembly stand in the Subassembly unit. The power section will next be united with the rear case or blower section and the nose section, before passing on to Final Assembly.

Cylinders and their component parts, disassembled and loaded on the overhead conveyor in Disassembly and Cleaning, by-pass Parts Inspection and Parts Repair, going directly to sand blast in the Cylinder and Valve unit. Here they are transferred to truck-racks, to go through the various sub-units including sand blasting, rework, valve grinding and seating, cylinder grinding and honing, and assembly.

In the "sand" blasting unit, cylinders are cleaned in a Pangborn blaster. Valves, pistons, valve-springs, washers and rocker-box covers are also cleaned in "sand" blast. Emerging from this unit, cylinders and their parts are loaded on trucks according to the type of operation for which they are scheduled. One line handles reworking of valves and four lines the various cylinder jobs. All cylinders pass through the grinding and honing sub-unit.

Pistons progress on a single line for removal of nicks and burrs, the checking of ring grooves and pin-fitting. Single lines assemble the pistons and cylinders, the pistons traveling on roller conveyor tables through the Zyglo test for cracks and flaws. In this test they are given an oil and chemical bath before visual inspection under a special lamp which gives them a purple

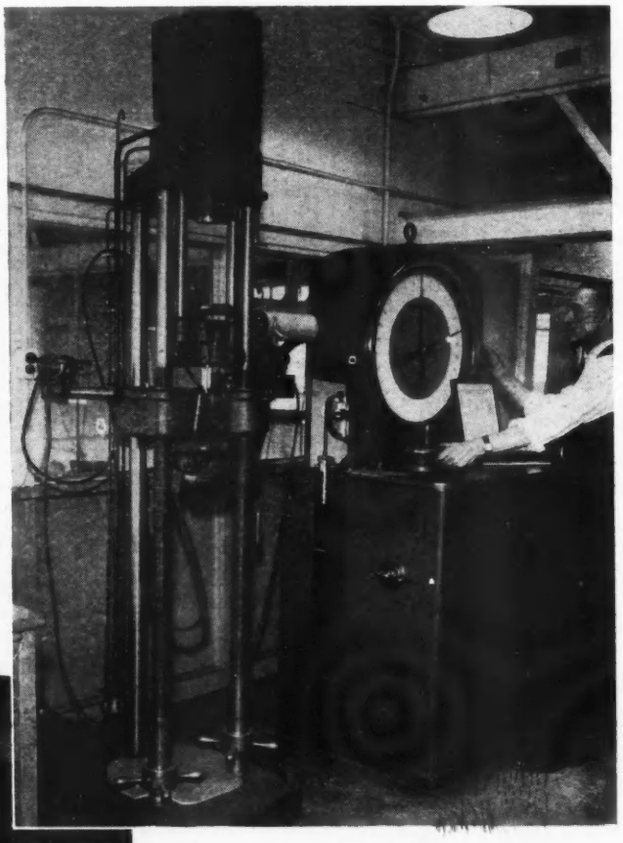
(*Turn to page* 60, *please*)

Aluminum Alloys Foundries

ONE of the important aluminum foundries of recent origin is the Aluminum Alloys Corp., Detroit, Mich., a specialist in permanent mold and sand castings—in large or small volume; and in sizes ranging from a one-ounce piece to a 12-cylinder engine crankcase or block. The name—Aluminum Alloys—is relatively new but the management and its know-how in engineering and aluminum foundry practice stem from the Ray-Day organization whose activity in the field of aluminum pistons has been known to our readers for some 25 years.

At the present writing the company has two separate plants in Detroit. The Walton plant—original home of Ray-Day permanent mold pistons—was converted into a modern aluminum sand foundry during the war and is equipped to handle a wide variety of sand castings in small and large lots. It has a capacity of about 20,000 pounds per day. The St. Aubin plant is entirely new. Built during the war period expressly for the production of aircraft engine parts such as blower housings, cylinder heads, crankcases, oil pans, etc., it employs both permanent mold and sand casting techniques. This plant also houses the Ray-Day piston operation—the production of permanent mold castings for original equipment and for motor car replacement use, as well as the machine shop for the finishing of pistons.

Although the art of producing aluminum castings is not new, the introduction of mass-production methods and advanced techniques leading to high levels of quality at costs competitive with ferrous foundry practice is a development of fairly recent origin. From a practical standpoint the aluminum foundry naturally must have the proper mechanical equipment. But its full service to the users requires other facilities. It takes a competent engineering department capable of advising on matters of product design; a modern metallurgical department for the control of materials and alloys and foundry practice;



(Above) View of 60,000 lb capacity Riehle hydraulic tensile testing machine in the metallurgical laboratory.

(Left) Here is the pouring of a large crankcase casting at the St. Aubin plant. Note the size of the mold. The gravity roller conveyor used on the pouring line is of special spring-mounted construction to insure freedom from shock or rough handling. Ladle temperature is checked with pyrometer before pouring.

Equipped for Large Scale Production

By Joseph Geschelin

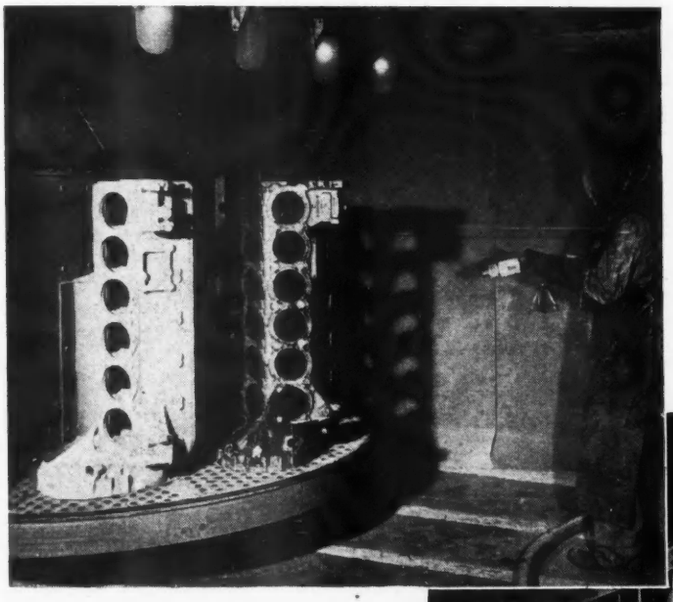
This is the 114th in the series of monthly production features

and above all an unquestioned know-how in the design of pattern equipment and permanent molds and in the details of specialized foundry practice, particularly that of gating and risering.

Such facilities are offered by Aluminum Alloys in its foundry management and in its laboratories. The metallurgical laboratory is centered at the St. Aubin plant. Here will be found equipment for physical testing and for X-ray and spectroscopic examination of parts and samples of metals. In addition, there is a complete chemical laboratory as well as equipment for checking and controlling sand for cores and molds. A smaller control laboratory is found at the Walton plant. One of the major responsibilities of the laboratory is the control of metals and foundry practice leading to exceptional quality at competitive cost. As an example of the flexibility of this organization, it is claimed that a pattern for almost any casting can pass through the gating and risering department and into the molding room in a matter of a few hours.

The St. Aubin plant is composed of two separate departments—permanent mold and sand casting—each one operating independently. At the present writing, the permanent mold department is producing pistons primarily, but it is prepared to handle a variety of parts in a wide range of sizes. The sand foundry is a compact establishment originally designed for the production of large aircraft engine castings such as blower housings, crankcases for V-type engines, oil pans, manifolds, and similar parts.

Equipment in this department includes a produc-



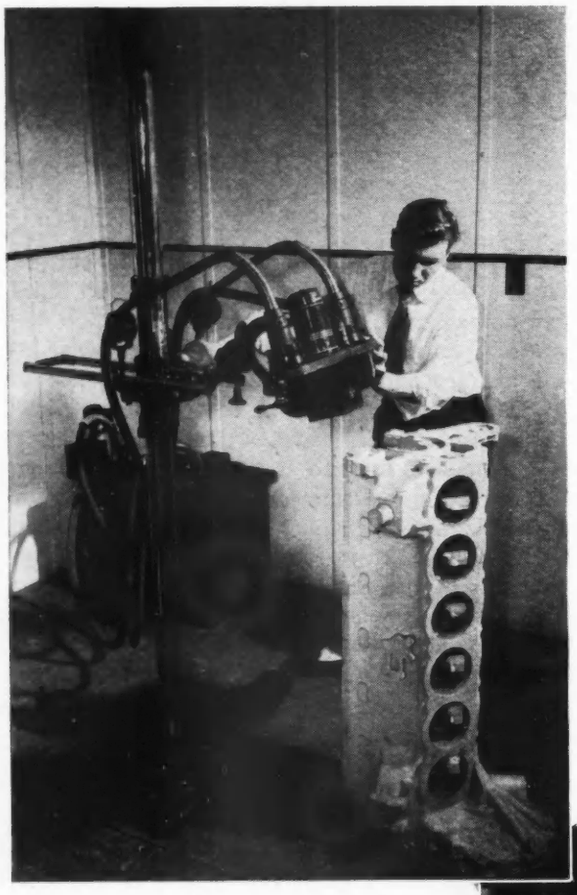
(Above) View of interior of Sly sand blast room contrasting a rough casting with one which has been finished.

(Right) Tapping of the 20,000 lb reverberatory furnace to start the pouring of alloy pigs. All of the metal is subjected to sampling tests by X-ray analysis and and physical testing before it is used.

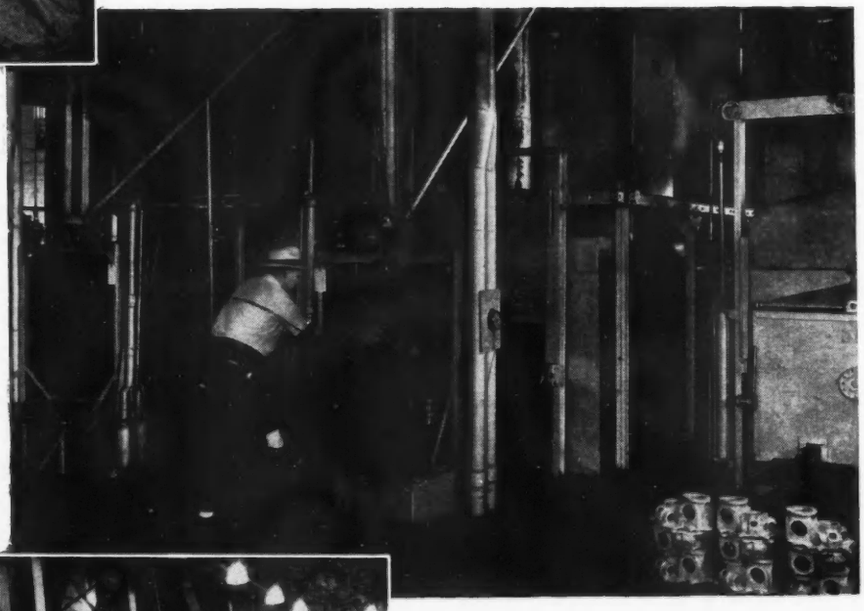
tion molding floor with its own self-contained sand conditioning and sand handling system. It features large molding machines, bedded in the floor, for the cope and drag, and a system of gravity roller conveyors with spring mounting for handling the large molds. An interesting core room serves the sand foundry. All of the cores are blown, using the familiar Osborn core-blowing equipment capable of producing the largest cores required for the operation. The department is served by its own sand handling system. A bank of transrack core ovens and a vertical tower oven complete the facilities in the core room. It may be noted at this point that the company specializes in high grade heat treated castings and has suitable heat treating ovens and quenching equipment in both plants.

Melting equipment in the St. Aubin plant consists of the following: three 2000-lb melting furnaces, two 1000-lb melting furnaces, and eight 350-lb units. For pouring, the metal is first melted in the furnaces, then transferred to smaller holding pots where the alloy is fluxed, kept free from dross, and held at the exact pouring temperature specified for each individual job by thermostatic control and checked by an immersed thermocouple pyrometer.

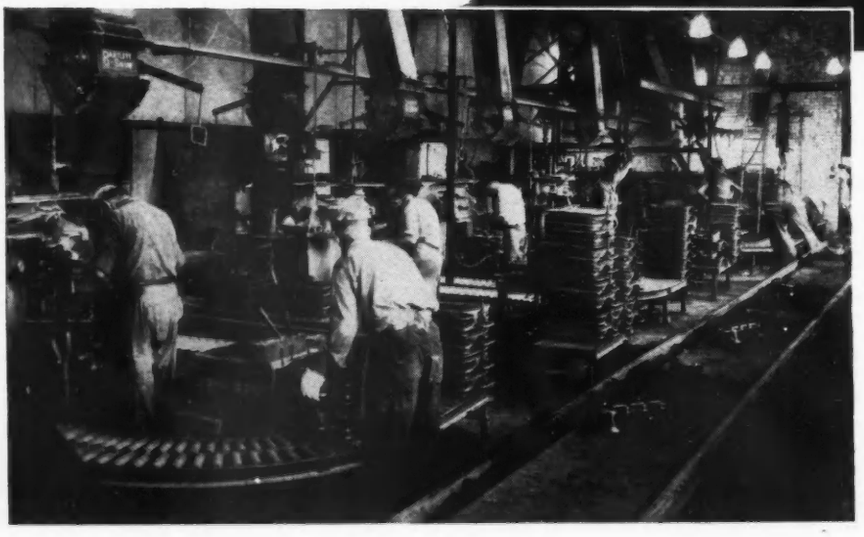
It also is a matter of importance that the company



(Above) Interior of X-ray laboratory showing the 140,000-volt General Electric machine set up for the examination of a large crankcase casting.



(Right) View of the battery of Ross and Despatch heat treating ovens at the Walton plant, showing the quenching pits in front, served by fast quenching elevators. Ovens are of recirculating type with pyrometer control and fast opening doors.



(Left) View of the production molding department at the Walton Plant. In the center of the unit in the foreground may be seen a Tabor molding machine with sand outlet overhead. At the right is the shake-out conveyor belt which links all molding stations.

Close-up of Cincinnati vertical milling machine which mills the relief in aircraft type pistons.

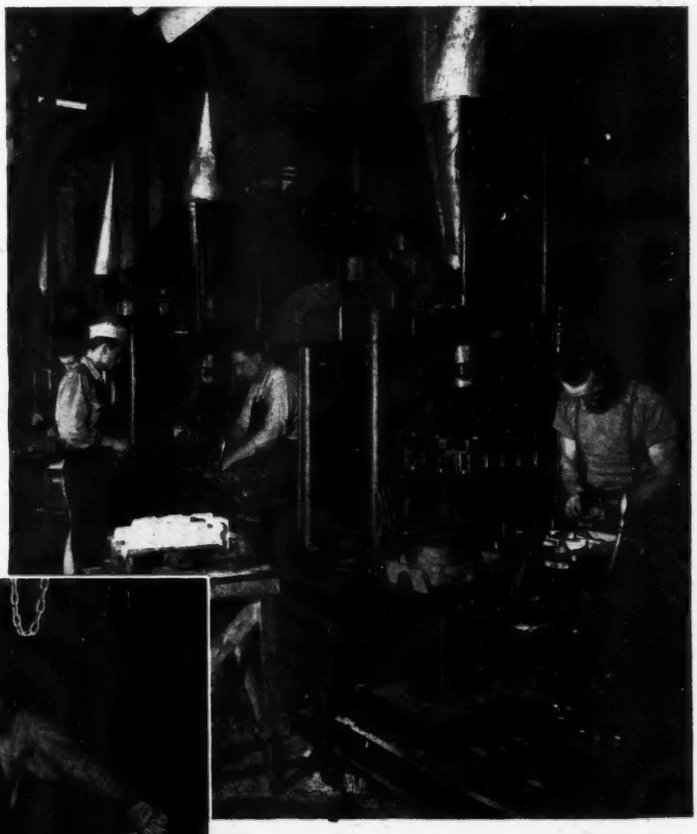
The piston machining department is equipped to produce 5000 to 6000 pistons per day. It is compact and self-contained, featuring some items of new precision machinery. Among these are precision-boring machines supplied by Heald and Ex-Cell-O and several Cincinnati vertical milling machines.

The Walton foundry represents an advanced type of operation for producing sand castings in a wide variety of sizes and ranging from small experimental runs to high volume setups. In layout it is designed for straight line flow from the pattern storage to the core room, then to the molding floor, pouring, shake-out, cut-off of gates and risers, snagging and grinding, heat treatment, inspection and shipping. Sand handling equipment in this plant was supplied by Bartlett-Snow and National Engineering.

The molding department is arranged in self-contained

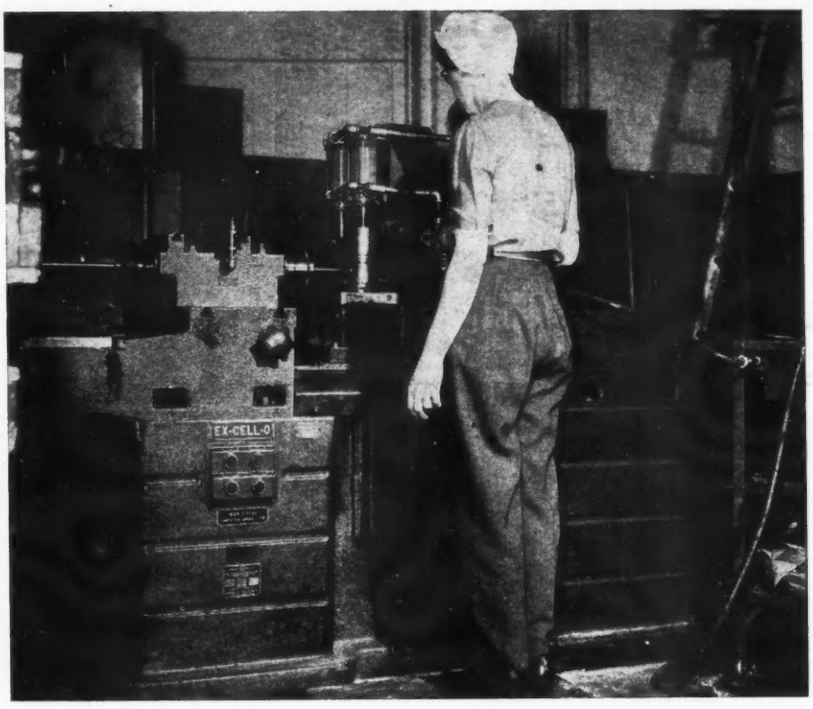
does its own alloying and produces its own pig for melting, using pure aluminum as well as remelt from scrap. The alloying furnace is a Loftus reverberatory type with a capacity of 20,000 lb. The metal is poured onto a mechanical conveyor carrying the molds for the pigs. Before the furnace is tapped the metal is purified with fluxes and nitrogen gas. During pouring the surface dross is skimmed by the operator. The resulting alloy pig supplies the needs of both foundries.

Facilities at St. Aubin are rounded out by a Sly sand blast room cabinet for cleaning large castings; and by the availability of water testing fixtures for all manner of pressure castings.



(Above) Section of the St. Aubin core room showing a few of the Osborn core blowing machines at work.

(Left) Close-up of one of the permanent mold machines at St. Aubin. This is a view of one of the larger machines and illustrates the practice of using controlled orifice pouring ladles to regulate pouring speed.



Close-up of Ex-Cello precision boring machine for the boring of piston pin holes to close tolerances.

stations consisting in each case of two Tabor or Osborn mechanical molding machines with a surrounding loop of gravity roller conveyor communicating with a shake-out belt running along the wall. Molds are opened by the operator and the flasks shaken out to facilitate re-use without delay. The castings are cleaned at the shake-out station outside of the molding department at the end of the belt conveyor line.

Following the shake-out, castings go to a group of Tannewitz metal cutting saws for the removal of gates and risers. Then the work is snagged or ground, if necessary, and sand blasted in a cabinet or in the case of small work is shot blasted in an American Wheelabrator. The castings then are heat treated in Ross or Despatch ovens which have built-in quenching tanks to facilitate the operation.

Gating and risering practice is a highly specialized technique requiring considerable know-how and oft-times demands a good deal of laboratory research for its final solution. When it comes to a matter of competitive costs, gating and risering practice affects not only the quality and soundness of castings but has an important bearing upon foundry cost, as well. For example, in both foundries gates and risers for most castings are so developed as to permit rapid sawing on the Tannewitz machines. However, in the case of large castings such as cylinder blocks and crankcases the gates and risers are so designed as to facilitate rapid removal on a special milling machine setup. This is only one example of the detail that must be followed in the interest of cost economy.

The St. Aubin plant also contains tool room facilities serving both foundries. In an operation which requires considerable use of metal patterns and special molds for the permanent mold equipment, good tool room facilities are a necessity.

Recent British Jet Propulsion Developments

METROPOLITAN-VICKERS company was engaged during the war in the research and development of jet propulsion gas turbines, embodying axial flow type compressors, with the compressor, combustion chamber and turbine arranged in line. Early engines of this type were cleared for flight as long ago as December, 1942, with a rated thrust of 1800 lb. They were the first axial compressor type units to fly in England. Engines of the latest series, the F2/4, have a thrust of 3500 lb at 7700 rpm, with a fuel consumption of 1.05 lb per lb thrust per hour, an overall length of 13 ft, 3 in., a maximum diameter of 36¾ in. and weigh 1750 lb. The first F2/4 engine ran its initial tests in January, 1944, and has completed a 100-hr endurance bench-test under type test conditions.

The Derwent, the Rolls-Royce jet propulsion engine that powered the Meteor IV on its record breaking flight of 606 mph, has been superseded by the Nene, which has a double entry centrifugal compressor, single stage turbine, and nine straight flow combustion chambers. The static thrust of the standard Derwent V unit is 3250 lb at 14,500 rpm. Static thrust of the Nene is 5000 lb at 12,300 rpm, with a specific fuel consumption of 1.06 lb per lb thrust per hour. The maximum diameter of the Nene is 49.5 in., the overall length 97 in., and the net weight 1550 lb compared with the Derwent's 42.5 in. diameter, 84 in. length and 1000 lb weight. The Nene was designed, manufactured and assembled in 5½ months, and was first run in October, 1944. The design performance has been surpassed and engines are now cleared for flight at a maximum thrust of 5000 lb.

Deemed most suitable for civil aviation operations is the "jet-prop" combination. The Bristol company announces that it has produced a gas turbine-propeller unit of high power and low fuel consumption—using aviation kerosene—and designed specifically for installation in long-range aircraft. It is the Theseus I, developing 2000 hp and substantial "jet" thrust in addition.

The Theseus I, which has a dry weight of 2310 lb, consists of a multi-stage axial-cum-centrifugal compressor which aspires air through an annular entry around the reduction gear. The compressed air is delivered through a heat exchange to a number of combustion chambers, where its temperature is further raised by the burning of injected fuel. The products of compression pass to a turbine which is directly coupled to the compressor, and thence to a further separate turbine stage, which drives through a forward extension shaft, the propeller reduction gearing. After leaving this turbine the gases pass though the heat exchanger where they give up some heat to the compressed air on its way to the combustion chambers. From the heat exchanger the exhaust gases are finally discharged through a controllable nozzle, thus producing forward thrust.

Aircraft Production Estimates for 1946

DURING 1945 the aircraft manufacturing industry of the United States produced a total of 47,000 military aircraft having a total airframe weight of 540,000,000 lb. The value of this production was approximately $8,320,000,000. As the year ended approximately 150,000 were employed in the industry and this is generally believed to be the "bottom" of the curve.

The aircraft manufacturing industry today has shrunk from its wartime position as largest in the world to a position of 15th or 16th in the United States. The bulk of its present work consists of continuing production of half-a-dozen specialized military types which will continue through the year. These are scheduled for production at a rate of less than 200 airplanes per month.

Immediate commercial job is largely the reconversion of military transport planes into luxury transports for the airlines, plus the production of civil transport types just entering production as the war ended. Prospects are that approximately 1000 such craft, all pre-war airline designs produced during the war for the Army and Navy transport services, will be converted. This work will continue through the Summer of 1946. Conversion of a four-engined transport requires six to eight weeks and costs between $150,000 and $200,000. This job is an emergency stop-gap for the airlines who plan to replace this equipment as rapidly as possible with new designs, most of which will not be available in quantity until 1947. Manufacturers of personal aircraft are in all-out conversion to peacetime production, but quantity output is not expected for several months.

Forecasts of production for 1946 range from $600,000,000 to $750,000,000 made up of around $500 million in military orders, $125 million in commercial transports and $100 million in personal aircraft production. Employment is not expected to increase greatly in 1946 and best estimates are that it will not exceed 200,000. Nearly half of these will be highly skilled engineers engaged in experimental work.

Personal Aircraft

Manufacturers of personal planes entered 1946, their first full peacetime year of production, with a backlog of cash plane orders far exceeding the 25,000 total number of personal planes in existence in 1941, which were produced over the preceding 6 years. Peak peacetime production (1941) was 6597. With reconversion from their wartime activity proceeding rapidly in all cases and completely accomplished in several, it is expected that actual production of personal aircraft will exceed 30,000 units during 1946. This, however, will fall far short of filling the 50,000 orders now on the books with more coming in daily.

Selected Statistics on Aircraft Industry

Production (units)	1939	1944	1945	1946*
Military	2,141	96,369	47,000	(est.)3,000
Transports	160	....	....	325
Personal	3,555	....	....	20,000
Production (value)				
Total (millions)	$280	$16,339	$8,320	(est.) $947
Floor Space (thousand sq. ft.)	9,455	156,093	**	44,800
Average Employment (excluding subcontractors)	61,000	1,176,500	***	206,500

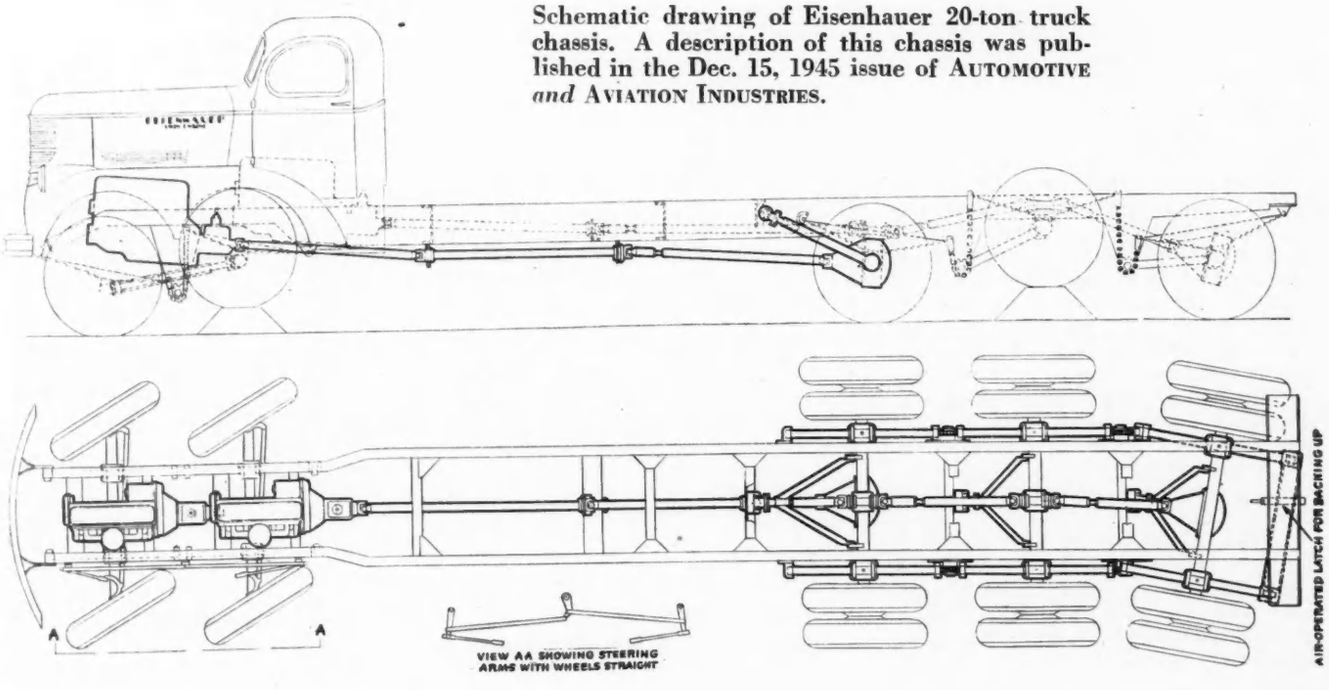
*Forecasts of minimum levels by the Air Coordinating Committee (Report of October 29, 1945).

**Declined sharply from V-E day on.

***Declined from 1,058,236 in January, 1945, to approximately 150,000 in December, 1945.

Eisenhauer 20-Ton Truck Chassis

Schematic drawing of Eisenhauer 20-ton truck chassis. A description of this chassis was published in the Dec. 15, 1945 issue of AUTOMOTIVE *and* AVIATION INDUSTRIES.



Recent Engineering Developments

MORE than 50 technical papers were presented at the 1946 SAE Annual Meeting held in January at Detroit. Hightlighting these sessions were a number of recent engineering developments in the automotive and aviation fields, among which were a series of new synthetic lubricants, rating of commercial vehicle brakes, suspension spring designs, gas turbine design data, effect of fuel properties on Diesel engine performance, combustion studies with a precombustion type Diesel engine, air control fixtures, the latest honing techniques, the influence of fuel volatility on induction system deposits, and others. Abstracts of papers on these subjects are given herewith; others will be published in early issues of AUTOMOTIVE AND AVIATION INDUSTRIES:

Effect of Fuel Properties on Diesel Engine Performance

By F. G. SHOEMAKER and H. M. GADEBUSCH, Detroit Diesel Engine Div., General Motors Corp.

IN ORDER to determine the effect of the cetane number of fuels on Diesel engine performance, the fuels listed in Table I were selected for test. These particular fuels were chosen because of their constant vaporizing characteristics, and included a spread of only 39 F in their final boiling points.

A graphical representation of the full load results obtained with these fuels is given in Fig. 1. The abscissa shows the elapsed time in milliseconds before and after top-dead center. The thin lines converging towards the top of the diagram indicate equal crank angle and the duration of the injection is outlined by the cross-sectioned area.

The diagram reveals first, that the ignition delay periods extend over approximately the same crank angle at all four engine speeds, or that less time is required to ignite and burn the fuel at high engine speeds. The fuels of different cetane rating show ignition delay in their respective order at the various speeds with exception of the 46 cetane fuel whose curve coincides with that of the 51 cetane fuel at all but the top speed. At the 1600 rpm point, all three fuels of 57, 51 and 46 cetane show identical ignition delay. Scanning the tabulated fuel properties for a possible explanation of this behavior, neither the boiling range nor the olefin content of these three fuels are materially different, and the only distinguishing factor is the higher content of aromatics of the 51 and 46 cetane fuels.

In the next phase of the combustion, in spite of the relatively large differences in ignition delay, only the 22 cetane fuel shows an appreciable effect of its later ignition. This fuel reaches maximum cylinder pressure much earlier than the other four, and is the only one showing the pressure peak before completion of the fuel injection. Although the 51 cetane fuel has a tendency to burn slowest during this period, the differences between the four fuels appear to be too small to indicate any major effect of cetane rating above 36 on the time of maximum pressure development.

The final combustion period shows that, in general, the higher cetane fuels burn faster than even the 57 cetane fuel at 2100 and 800 rpm and fall back to their respective places at the 1200 rpm speed. The much earlier termination of the combustion at the lowest speed is due to an air deficiency of the engine for the high fuel input used during these tests. Later work at reduced fuel delivery proved these curves to continue normally in the direction given by the three higher speeds, indicating the same time interval for normal combustion.

For investigation of the influence of the vaporizing characteristics, a group of four other fuels was chosen. The ignitability of the fuels varied within four cetane numbers, while their final boiling points differed as much as 184 F. The aromatics content was in the same order, but the olefin content covered a wide range. The ignition delay of all fuels of this group was practically alike and well within the range of the corresponding fuels of the cetane group. Maximum cylinder pressure was reached at approximately the same time as before, and the location of the second group of fuels at the end of the final burning period likewise indicated that no important influence of the boiling range appears to exist on the pressure development during combustion at full load.

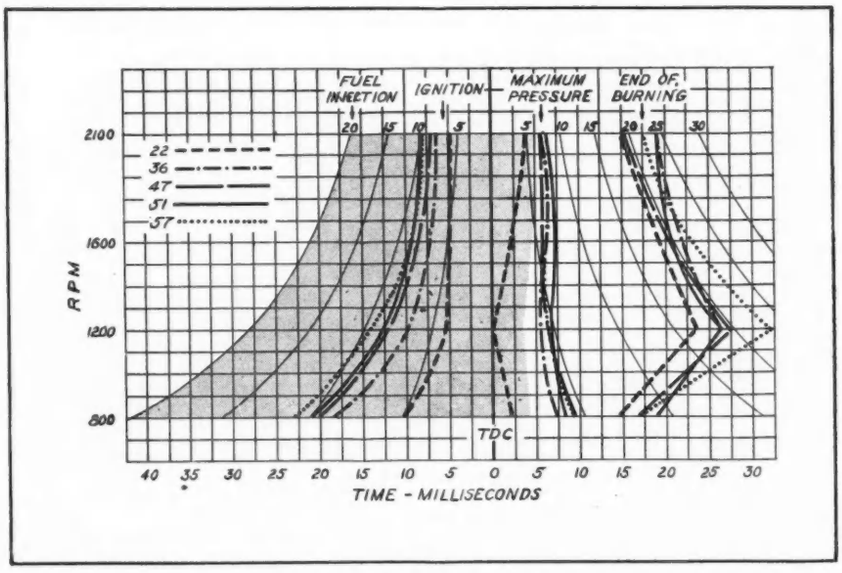


Fig. 1—Test results showing the effect of various cetane fuels on full load operation of a Diesel engine.

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Table I—Characteristics of Diesel fuels tested

Cetane Number	Volatility of F.B.P.	General Composition	Olefins (Bromine No.)	Aromatics (Special Dispersion)
57	649	P	1.4	109
51	638	P,N,A	2.1	122
46	610	P,A,IP	2.1	137
36	642	P,O,IP	18.1	107
22	620	O,IP	27.0	102

(P) Paraffins (N) Naphthenes (IP) Iso-Paraffins
(O) Olefins (A) Aromatics

Identical results were obtained in the part load range down to 50 per cent load, and for all fuels tested, neither power output nor fuel consumption showed greater variations than those normally traceable to the slightly different fuel input, to the influence of viscosity and gravity, and the differences in heating value.

It is concluded, that as far as combustion, power and economy are concerned, fuel variations within a wide range of properties have no significant effect on this type of a direct injection engine over the normal range of working loads and speeds.

Review of Brake Designs and Methods of Rating Brakes for Commercial Automotive Vehicles

By RALPH K. SUPER,
The Timken-Detroit Axle Co.

TEST figures show average temperatures for a brake drum under severe service conditions to be 400 F on the outside of the brake ring for a comparable temperature of 1100 F on the inside braking surface. The surrounding air temperature generally averages 100 F. Generalizing somewhat, it is reasonable to say that the heat dissipating capacity of the outside of the brake drum approximates the product of the circumference of the drum (πD), the width of brake (W), a combined heat dissipation constant (C), and the differential in temperature between the drum surface and outside air. With the temperatures mentioned, the formula for drum heat dissipating capacity would be:

Dissipating Capacity (outside)
$= \pi DWC\ (400° - 100°)$
$= 300\ \pi DWC$

Results from the field justify the assumption that the inside area of the brake drum can also contribute to the total heat dissipating capacity of the brake drum. For the purpose in this example, it is convenient to use the diameter of the brake drum as 0.9 of the outside diameter and the dissipating capacity of the inside surface would then be:

Dissipating Capacity (inside)
$= \frac{(360 - \text{Total Lining Arc})}{360} \times$
$0.9\ \pi DWC\ (1100° - 100°)$

If the lining covers the entire braking surface of the drum, the first factor will be zero and no additional capacity will be obtained from this surface by circulating air in the brake cavity. If, however, brake shoes with a total lining coverage of 240 deg are used as a basis for capacity, the following figures are obtained:

Dissipating Capacity (inside) $=$
$\frac{(360 - 240)}{360} 0.9\ \pi DWC\ (1100° - 100°)$
$= 300\ \pi DWC$

Combining the exposed inside and outside surfaces, the total heat dissipating capacity of the brake drum can thus be doubled by removing one-third of the lining and exposing the braking surface. The high temperature of the inside surface provides the differential with the circulating air. Such heat as is lost from this surface need not be carried through the drum. This is not a theoretical analysis which has no factual basis in actual vehicle operation, for the results obtained in the field have also been checked in the laboratory.

In a recent laboratory test, a conventional two-shoe hinged-anchor, heavy-duty bus brake was installed on the dynamometer. The brake was subjected to a series of stops simulating transit bus service. The torque output of the brake was held constant to secure a retarding rate equivalent to 10 fps per sec. The cam torque input was varied to obtain this figure. The object of this test was to determine the effect on the performance of the brake of decreasing the length of the brake liners on the two brake shoes. The original shoes had liners 116 deg long. Duplicate tests of 500 stops each were made on each set of liners, which were reduced in length by removing five deg of arc length of the liner from both the cam and anchor end. The changes in length in 10 deg increments per shoe were continued until only 56 deg of liner material was left on each shoe. Observations of drum temperatures and operating pressures were made and recorded during the test and the thickness of the liner was measured at the conclusion of 500 stops.

The results of this test are shown in Fig. 2 in the form of curves. It is im-

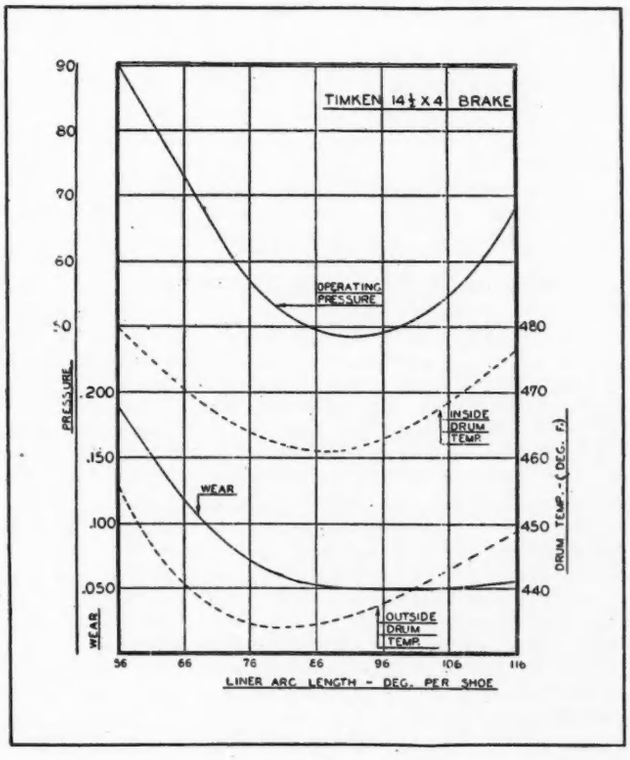

Fig. 2. Test results of a Timken 14½ x 4 brake, showing the relationship of wear, operating pressure and temperature to the length of brake shoe

portant to note that with the decrease in liner length, the drum temperature decreased with the resultant reduction in the rate of liner wear. Also, it is interesting to note that the air pressure required to make the stop shows a decrease. This indicates that the brake is more effective. The curves reach a minimum point at 96 deg of liner length per shoe, after which an increase in the various factors is evident.

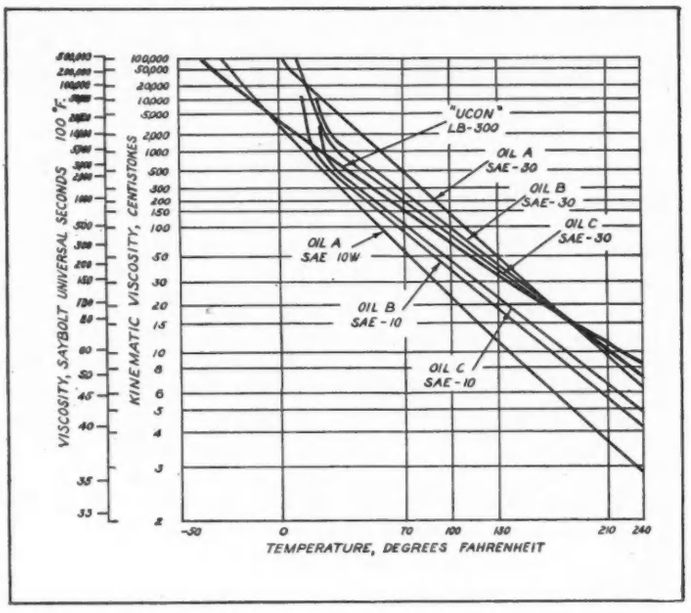

Fig. 3. Viscosity - Temperature relationships of petroleum oils and synthetic lubricant LB-300. Oil A is Coastal, oil B is Mid-continent and oil C is Pennsylvania.

New Synthetic Lubricants

By J. C. KRATZER,
The Linde Air Products Co.,
D. H. GREEN,
National Carbon Co., Inc.,
and D. B. WILLIAMS,
Carbide and Carbon Chemicals Corp.

THE new synthetic lubricants dealt with here are synthesized from natural or other hydrocarbon gases as raw materials, and contain no petroleum oils. They are inherently more expensive to produce than the best petroleum lubricants now sold. This factor will probably limit the market for these products except where their special properties justify increased cost. The LB series is water-insoluble and the 50-HB series is water-soluble.

The LB series, because of its special properties, is best adapted for the lubrication of machinery in general, including internal combustion engines. Physical data for some of the common viscosity grades of lubricants of the LB series are given in Table II.

These compounds may be prepared in any desired viscosity by controlling the reaction employed in the manufacturing process. The high viscosity indices, characteristic of both series of lubricants, is inherent and not dependent on viscosity index improvers. The SAE viscosity classification of lubricating oils classifies in terms of viscosity only, and does not take into consideration viscosity-temperature relationship of the lubricant. According to the SAE classification system, lubricant LB-300 (Prestone motor oil) is an SAE 20 oil. However, because of its high viscosity index, 142, it is equal in viscosity to most SAE 10 petroleum oils at 0 F, and to most SAE 30 oils at 210 F. Fig. 3 shows the product is not adequately described as an SAE 20 oil, and this one grade of synthetic lubricant covers the range of the normal SAE 10, 20 and 30 grades of petroleum oils.

The oxidation products of the synthetic lubricants are, for the most part, low molecular weight volatile compounds while in the normal process of oxidation of mineral oil, non-volatile products are formed which eventually convert to oil-insoluble sludges, gum and varnish. In the case of the synthetic lubricant, insoluble oxidation products which tend to foul an engine are not formed, and this factor is responsible for negligible increase in the viscosity of the lubricant with use. Typical 36-hr Chevrolet engine test results, a generally accepted means of evaluating oxidation resistance of a lubricant and its corrosive effect on copper-lead bearings, are given in Table III. Data for a heavy-duty oil B-3 are presented for comparison.

Synthetic lubricant LB-550 has been used extensively in aircraft engines by the Army Air Forces and the Air Transport Command. To date, over 150,000 engine hours have been accumulated on this lubricant. Some of the engines operated over 900 hours before overhaul. As a result of this experience, the following conclusions were drawn: Engine starts at ambient air temperatures of —15 F without gasoline dilution were possible; freedom from sludge and varnish was clearly demonstrated; oil cooler tubes remained relatively free of sludge accumulations; feathering propellers hydraulically by the engine oil was possible down to —60 F; some increased leakage was observed, and engines operated on the synthetic lubricant were much easier to

Table II. Properties of "UCON" Brand Lubricants—LB Series

		LB-140	LB-300	LB-400	LB-550	LB-650
Viscosity Saybolt Seconds @	210 F	45.5	62.7	74.3	91.9	107
	100 F	140	300	400	550	650
	0 F	4960	18380	27600	40800	50500
	—30 F	42100	183000	264000	444000	540000
	—50 F	265000	1370000	2335000	3890000	—
Viscosity Centistokes, @	210 F	5.9	11.0	14.1	18.5	22.0
	100 F	29.8	65.0	86.6	119	141
	0 F	1080	4000	6000	8900	11000
	—30 F	9200	40000	62000	97000	118000
	—50 F	58000	300000	510000	850000	—
V. I. (ASTM D-567-41)		147	142	142	140	140
Pour Point (ASTM D-97-39), °F		—50	—40	—35	—30	—25
Density @ 210°F. (g/cc)		0.921	0.933	0.936	0.939	0.940
Density @ 100°F. (g/cc)		0.966	0.979	0.983	0.985	0.986
Specific Gravity @ 60 F		0.983	0.997	1.001	1.003	1.004
Gravity °API @ 60 F		12.5	10.5	9.7	9.5	94.
Flash Point (ASTM D-92-33), °F		440	470	485	510	525
Fire Point (ASTM D-92-33), °F		510	570	580	580	580
Carbon Residue (ASTM D-189-41)		Less than 0.01 per cent				
Ash (ASTM D-482-43-T)		Less than 0.01 per cent				

Table III. 36-hr Chevrolet Oxidation Test on LB-300 Lubricant and Oil B-3

		LB-300	Oil B-3
Engine Cleanliness Rating	Varnish	48.7	47.1
	Sludge	46.1	46.9
	Total	92.8	94.0
Cu-Pb Bearing	Weight Loss in Grams per ½ Bearing Insert	0.137	0.210
Oil	% Viscosity Increase	8.0	25.0
Deterioration	Free Acid mg./gm.	0.012	....
	Total Acid mg./gm.	0.050	....
	Per Cent Ash	0.240	....
Neutralization No.		....	0.65
Conradson Carbon		....	1.90

clean up during overhaul than engines operated on petroleum oil.

Combustion in a Pre-combustion Type Diesel Engine

By HARRY F. BRYAN,
International Harvester Co.

COMBUSTION tests were run on a four-stroke pre-combustion type Diesel single cylinder test engine under the conditions shown in Table IV. Photographs showing the burning, and indicator cards showing the pressure changes in the pre-combustion chamber, were made at the same time. The correlation between indicator card and combustion photographs was fairly good. The combustion portion of the pressure-time curve is given in Fig. 4.

Whenever a pressure card of this form is to be analyzed, the assumption is usually made that combustion takes place at constant volume because of the very small amount of piston movement during combustion. However, the effect cannot be neglected in the Diesel because of the small combustion volume in these engines. A method of "sorting out" the pressure rise due to combustion and the pressure rise due to piston motion from the total pressure on the pressure card was then proposed. After a careful study of the results obtained with this method of analysis, it was concluded that the per cent of mass (fuel and air) burned at any instant in an engine explosion can be determined with fair certainty from the indicator card, by finding the per cent pressure rise due to combustion at any instant.

Plotted against crank angle curve "A" in Fig. 5, are the values for per cent pressure rise due to combustion, as obtained from the pressure-time curve in Fig. 4. The rate of pressure rise due to combustion at any instant of the combustion period can be taken from the slope of this curve. The maximum rate of pressure rise occurs 6¼ deg crank angle after ignition and 82 per cent of the total pressure rise is attained at top dead center.

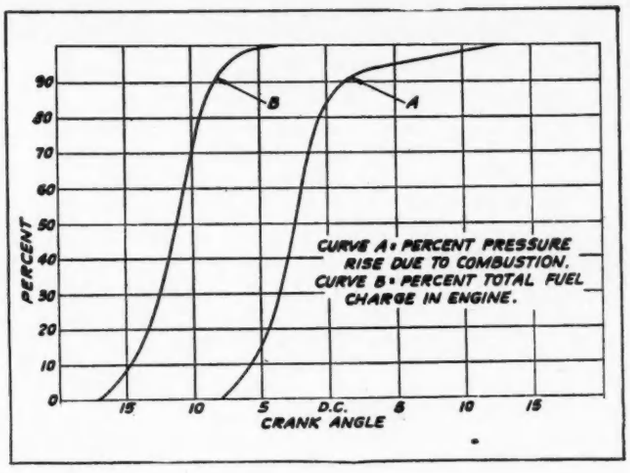

Fig. 5—Comparative curves of (A) per cent of pressure rise due to combustion and (B) per cent of fuel charge present at any instant during injection, plotted against degree of crank angle

If the per cent of the total fuel charge present in the engine at any instant during injection is plotted in its observed relation to top dead center, as in curve "B" of Fig. 5, and if the assumption is made that curve "A" represents the per cent of mass (mixture fuel and air) burned at any instant during combustion, it is possible to make a direct comparison between the energy available in the combustion chamber at any instant and the rate of energy liberation by combustion. The degree of crank angle separating the two curves at any point show the ignition lag of the fuel at that point.

The curves "A" and "B" in this case are approximately parallel. This would indicate that although ignition occurs 8.8 deg crank angle after the start of injection, the fuel is vaporized, diffused into the air and burned, at the same rate that it was discharged into the combustion chamber. This is truly interesting when it is considered that 86 per cent of the total charge of fuel is in the chamber at the time of ignition. These curves show that it is possible to have the rate of burning equal to the rate of fuel injection. In this case, however, the rate of burning is too high for smooth performance. To alleviate this condition, either the rate of fuel injection or the rate of burning must be reduced.

The curve "B" is more or less representative of the rate of fuel injection from injection systems with multi-cylinder pumps and comparatively long injection pipes. Some variation in the duration of injection can be obtained in these systems by changing pump plunger size, injection line volumes, pump cams, opening pressures and the like, but the general shape of the curve will remain approximately the same because of the effect of fuel compressibility.

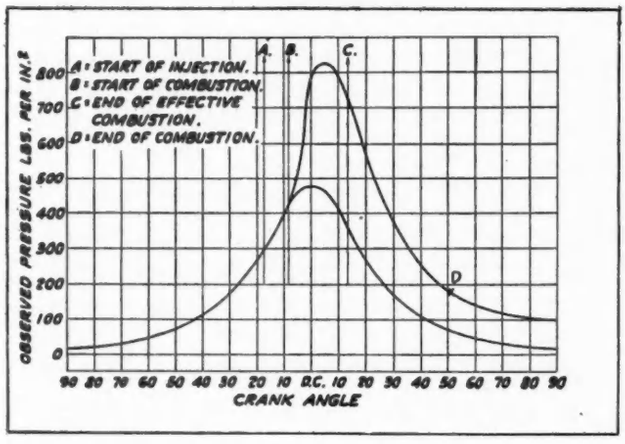

Fig. 4—Pressure-time curve for combustion in a pre-combustion chamber type Diesel engine

Table IV. Operating Conditions for Diesel Pre-combustion Chamber Test

Engine speed	595 rpm
Nozzle opening pressure	700 psi
Compression ratio	13.67 to 1
Injection pump port closing	23.5 deg BTDC
Actual start of injection	17.6 deg BTDC
Actual start of injection	8.83 deg BTDC
Entering air temperature	115 F
Temperature at nozzle	180 F
Precup wall temperature—top	335 F
Precup wall temperature—bottom	330 F
Cylinder wall temperature	255 F

Flexible or Spring Medium of Suspensions

By ROBERT SCHILLING,
General Motors Corp.

THE process of coldsetting is applicable for all springs or any structural parts which are loaded in one direction only, whether the stresses are shear or bending. It may well be used on suspension parts such as axles or wheel arms, where settling under load is a limiting design factor.

When a part is being loaded, some portions will reach their yield stress long before others, either because they are subject to stress concentration from fillets or surface defects and inclusions, or because they are highly stressed due

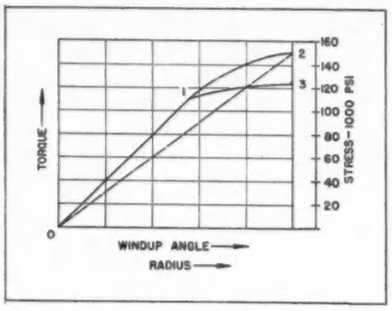

Fig. 6. The effect of presetting on a torsion bar spring.

to the normal stress distribution. These parts will then yield during the first load application, and at maximum load will be loaded just to the yield stress. This means that the part will take a set during this first application. If the service load is the same as the presetting load, the settling in service will be much reduced. If the service load is less than the presetting load, no portion of the material will ever again be loaded up to its yield stress, so that settling becomes quite small and fatigue life is improved. For best results, the spring should be designed so that it can be preset past the operating load. Springs with limiting solid height such as helical coil springs and ring springs should be designed so that they are not compressed solidly in service.

How much presetting can increase the capacity of a spring is shown in Fig. 6 for a torsion bar spring. The solid line 0, 1, 2 is the load deflection curve of a bar during the presetting operation. The scales to the left show the torque applied, those on the right show nominal stress, calculated as torque divided by section modulus.

At point 1 the stress, at the outermost fibers, has reached 110,000 psi, the yield stress of the material. From then on the bar begins to yield, at the outer fibers first and then progressively toward the center as the windup increases, and the torque, therefore, increases more and more slowly along curve 1 - 3. From this curve the stress at the outer fiber can be calculated at any stage. The gradual increase of stress at this point is due to increasing yield strength caused by work hardening. The line 0, 1, 3 is then actually the stress-strain curve of the material, and also shows the stress distribution along one radius, from center to surface, under the highest presetting load.

If the bar carried the maximum torque elastically, the surface stress would have to be 152,000 psi as indicated by point 2, and the stress at any point along a radius would then be indicated by the straight line 0 - 2. If the load is removed, the bar unwinds elastically, and all stresses decrease by an amount corresponding to the ordinates of line 0 - 2. The difference between line 0 - 2 and line 0, 1, 3 will then remain as trapped stress. Consequently the load stress or stress range is equal to the nominal stress, but the maximum total stress is given by line 0, 1, 3.

Air Fixtures and Air Controls

By S. JOHNSON, Jr.,
Bendix-Westinghouse Automotive Air Brake Co.

THERE are several advantages of air operation of fixtures, but the chief one is labor economy. Air controls are positive and have proved their worth from a standpoint of increasing production per man hour, and have indirectly contributed a great deal to safety in the shop.

The air controls are standard parts for the air brake system for automotive vehicles, are high production items and are, therefore, relatively inexpensive. The brake chamber consists of two metal plates, a molded composition rubber and fabric diaphragm and a push plate with a push rod attached. The brake chamber has been found preferable to cylinders. Since a diaphragm is employed instead of a packing cup, leakage and friction problems are not involved. Because of these two reasons, there is no maintenance problem since the diaphragms have an average life of about 1,000,000 cycles.

A control valve is used to operate the brake chamber. This can be one of many types, but in a majority of cases, a simple rotary disk-type valve is used. A regular key type cock is not desirable, because the frequency of operation causes too much wear and excessive leakage develops.

One application is on a milling fixture used for straddle milling of small compressor crankcases as shown in Fig. 7. This fixture, used on a Cincinnati Duplex Hydromatic milling machine, replaces an old style bar type fixture that required two nuts and a large end wrench to operate. The present clamp involves only a quarter turn of the handle on a two-way valve to operate the brake chamber fixture. The former standard allowed 0.623 minutes handling time per piece, as compared with the new allowed time of 0.176 minutes per piece.

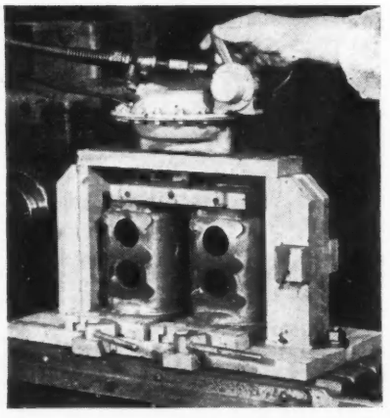

Fig. 7. Air operated milling fixture on a Cincinnati Duplex Hydromatic milling machine for straddle milling small compressor crankcases, two at a time

Another interesting application, is that shown in Fig. 8, which is a fixture used to make pneumatic inspection tests on a treadle Type Air brake valve assembly, a large production item. The fixture was designed to eliminate manual screwing of fittings to the part during test. The number one valve operates the top brake chamber to secure the valve in the fixture. The number two valve advances three plungers at once to close the ports on the valve. The steady pressure exerted by the brake chamber gives an air tight seal, insuring an accurate test. The two-way valve mounted on the bench turns on the air for the leakage test. The valve on the right supplies air to an air cylinder that actuates the pedal of the valve, as in actual operating conditions. The savings realized on this operation amounts to $0.026 per valve or $128.50 per month.

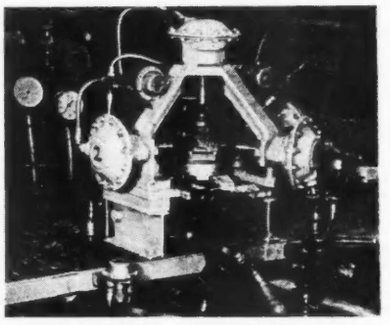

Fig. 8. Air-operated fixture used for making pneumatic inspection tests on a treadle type air brake valve assembly.

Aircraft Engine Induction System Deposits

By W. J. SWEENEY, J. F. KUNC, JR., and W. E. MORRIS,
Standard Oil Development Co.

THE DATA presented in Fig. 9 show the pertinent results obtained in tests made in a full scale engine to study the influence of fuel volatility on induction system deposition. In these tests four fuels varying in ASTM 90 per cent point from 196 to 282 F and in ASTM final boiling point from 263 to 342 F were run at a carburetor air temperature of 100 F. All of the fuels contained 10 lb of inhibitor B per 5000 gal. In Fig. 9 the amount of deposit formed in the induction system of the engine is plotted as a function of both the ASTM 90 per cent point and the ASTM final boiling point of the fuels in question. The data indicate that maximum deposition was obtained with the fuel having ASTM 90 per cent and final boiling points of 210 and 263 F respectively. Based on a consideration

of the ASTM 90 per cent point data alone it would be concluded that deposition went through a maximum at a value of roughly 210-215 F as the volatility was varied. However, it will be noted that deposition tended to decrease with increasing ASTM final boiling point of the fuel. From these data it cannot be determined whether the ASTM 90 per cent or the final boiling point is a better criterion of the deposit forming characteristics of a fuel. In any event, it is obvious that a relatively small change in fuel volatility may have an appreciable influence on deposition characteristics. It is of interest to mention that no induction system deposit complaints have ever been reported on any of the Grade 100/130 fuels used by the Armed Forces throughout the war. These fuels, in general, had ASTM 90 per cent points above 260 F and were specified to contain not less than 0.8 and not more than 1.0 lb of inhibitor per 5000 gal.

Since the conditions under which an engine is operated would also be expected to influence the degree to which a fuel is vaporized in the engine induction system, a study was made of the effect of intake air temperature on intake system deposition. In these tests the fuels having ASTM 90 per cent points of 212 and 263 F, respectively, were run at carburetor air temperatures at 50, 75 and 100 F. It was found that at a given air temperature the fuel having an ASTM 90 per cent point of 212 F gave a greater amount of deposit than the fuel with an ASTM 90 per cent point of 263 F. In addition, both fuels gave the greatest amount of deposition at the highest carburetor air temperature investigated, namely, 100 F. In the case of the less volatile fuel, deposition was found to decrease with decreasing air temperature, whereas with the fuel having an ASTM 90 per cent point of 212 F the minimum amount of deposition was obtained when employing a carburetor air temperature of 75 F. Whether this latter trend is valid or not is open to question, since the spread between the values obtained at 50 and 75 F carburetor air temperatures are small and may be within the limits of experimental error of the tests.

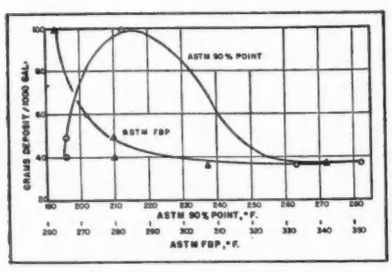

Fig. 9. Effect of fuel volatility on deposit formation in a full scale test engine

Latest Developments in Honing Techniques

By LAWRENCE S. MARTZ and DOUGLAS T. PEDEN,
Micromatic Hone Corp.

THE most recent and one of the most important developments in the honing process since it was originated is the hone abrading method, using many thousands of simultaneous cutting contacts, actuated in low, impulse-force shearing action under low speed and low pressure. Modern honing now removes from 25 to 30 times as much metal as was formerly practicable, and, in some applications it can do this work up to six or eight times as fast as was formerly possible.

Heavier, faster stock removal in hone abrading has been accomplished by two developments: additive treatments of bonding material, and multiple and progressing honing using two- and three-spindle machines, equipped with rotating, indexing fixtures. Additive treatments of bonding material compensate for variations of grit condensations and bond densities which occur in some varying degree in all vitrified structures. They further serve to reinforce softer, vitrified bonded stones, and thereby increase the cutting efficiency and stone life by as much as several hundred per cent. For example, treated stones, used in honing an 8 1/8 in. diam by 42 in. long cast iron Diesel engine sleeve, removing 0.008 in. stock on diameter, produced 18 to 20 bores per set of stones as compared with five to six bores with untreated stones. Another Diesel sleeve manufacturer, using treated stones for honing a 4 3/8 in. diam by 11 1/8 in. long cast iron sleeve, removing up to 0.035 in. stock per sleeve, obtained production at rates varying from 0.008 in. to 0.011 in. stock removal per min. The effectiveness of these treatments is further evidenced in another sleeve application, where they now get 2000 to 2100 bores per set of stones as compared with 350 to 400 with untreated stones.

The new size controls used in honing are either of mechanical or fluid pressure types. In the mechanical type size control, the abrasive members in the honing tool are mounted in a plastic shell which serves as the stoneholder. An extended plastic end tab at each end of the stone, while wearing away as the stone wears down, is allowed to enter a precision sizing ring at the end of the reciprocating stroke. Then, when the stones have expanded to the desired bore sizing ring size, frictional resistance of the tabs on the sizing ring turn the ring, tripping a micro switch which stops the honing operation. Fluid pressure type size control is based on the Solex principle of metering the back-pressure on a fluid escaping from a number of orifices in the honing tool body.

Gas Turbines

Engineering Development of the Jet Engine and Gas Turbine Burner

By FRANK C. MOCK,
Bendix Products Div.,
Bendix Aviation Corp.

TO ACHIEVE the desired high liberation of energy within a small volume of combustion, it is necessary to employ a fairly high degree of air turbulence; and since turbulence under certain conditions will oppose the spread of flame, turbulence control is one of the most vital and difficult problems in burner development.

Air currents induced by spray, as shown at "A," Fig. 10, are clearly marked and are one of the chief difficulties in maintaining stable flame at low fuel deliveries. Any step such as "C," that shelters the spray cone from these currents will help stable idling and will improve starting ignition to a marked degree.

Air currents through holes tend to persist for a considerable distance, and, when the air is cool at least, tend to stop combustion in their path as shown in "B." It is sometimes possible to see these paths in violet or dark outline through the flame. Once a high rate of combustion has been initiated, however, multiple holes give a very satisfactory air dilution and local turbu-

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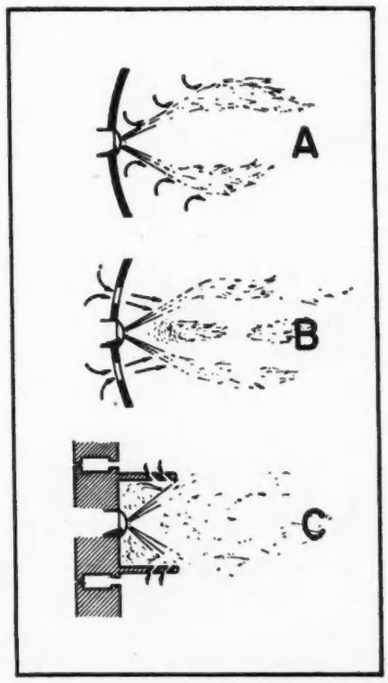


Fig. 10. Diagrammatic sketch of various burner elements and baffling arrangements

Steel Strike Heavy Blow to All Members of the Industry

Walkout of Steelworkers Promises to Cripple Production More Effectively than Even the Three-Month Glass Strike

Just as the automobile industry was starting to pick up momentum toward the end of January, it received the worst blow yet to fall on its bedeviled head. The walkout of most of the steel workers in the country promised to be a more crippling blow than even the glass strike, which had run for three months. The fact that the glass stoppage was settled at almost the same time that the steel workers struck was small comfort. Most companies had been able to struggle along with at least partial production while glass was in short supply, but if steel stays shut down for more than a comparatively short period, the outlook is dismal indeed for automobile production to last more than a month at the outside from the date the strike was called.

Ford Motor Co. is perhaps in the most fortunate position in regard to steel, just as it was in the glass strike. The only reason that Ford could continue to make progress in increasing production was that it had its own glass plant at Minneapolis which turns out sheet and plate glass. The plate goes into windshields and the sheet is laminated into safety window glass at the Rouge plant. In steel, the company also has its own mill, although it does not have sufficient capacity to meet more than two-thirds of requirements at production levels prevailing in mid-January. 1937 Fords, 163 Mercurys, 39 Lincolns, and 1046 commercial cars and trucks and buses, for a total of 2647 units were turned out Jan. 17. The company ordinarily produces about 40 per cent of its own steel, but at full blast, the mill now is supplying approximately 60 per cent. Another complication is that Ford must furnish some of its suppliers with steel, since they have been unable to get enough from other sources to keep operating. How long the company can continue to operate in the face of a continued steel strike is uncertain. Estimates in Detroit are that it could not be for more than two or three weeks, although this figure is strictly a guess.

Nash, which had been closed since late December on account of the glass strike, had made arrangements to get going again by February, even though the glass strike were still on. The company is reported to have an inventory of steel which will permit production for a short period, although no definite estimate of how long operations could continue was forthcoming. During the forced suspension, Nash had built up a good backlog of sub-assemblies and with glass again available the question appeared to be whether to start and run until steel gives out or to wait until continued production is assured.

Chrysler Corporation is non-committal about its reserve of steel but a representative of the steel industry reported just prior to the strike that the corporation had been able to acquire a sizeable stock which it had stored in and around Detroit. The Dodge division had been forced to suspend operations indefinitely on Jan. 18 because of the shortage of glass, but with the glass strike settled, this shortage at least has been overcome, and production resumed. Although the corporation would give out no production figures, it is estimated that production in mid-January was about 1000 cars per day with Plymouth accounting for about 350, Dodge 300, and Chrysler and DeSoto providing the rest.

Studebaker Corporation is reported to be encountering difficulty in stepping up production. After being shut down most of the last quarter of 1945, the company finally got going in January, but an uncertain and uneasy labor situation is reported to have developed which greatly hampered production efforts. As far as materials go, Studebaker probably faces no great difficulty for a while since it had ample opportunity to build up sub-assemblies and inventories of stocks during the enforced period of idleness.

In general, it probably would not be far from correct to estimate that most companies had on hand or available in warehouses a 30-day supply of steel on the average. However, a complicating factor is that suppliers may not have

(*Turn to page* 44, *please*)

Another New Car Maker May Soon Enter Field

Another new automobile manufacturing company is expected to enter the field soon with a rear-engine drive car, according to reports. It is understood the company, which will be capitalized for $40 million, will take over the huge Dodge-Chicago plant in Chicago. The car the company is planning to build is said to be the Tucker Torpedo, designed by Preston Tucker, Ypsilanti, Mich., engineer. Reports describing the Torpedo say its chief feature is a hydraulic torque converter which transmits power directly from the engine, to the rear wheels, eliminating clutch, transmission, drive-shaft and differential.

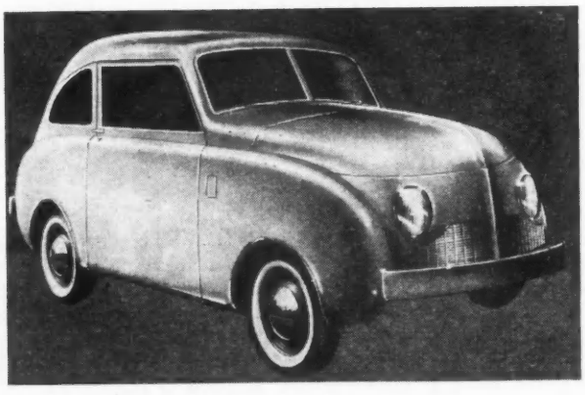
The engine is reported to be a two-cylinder design with a one-piece cast aluminum block. It is said to have a fuel injection system and to weigh about 250 lb.

A unique feature claimed for it is that it is a sealed unit which can be quickly removed for rebuilding or replacement.

The designer reports that the chassis will be of tubular steel construction,

(*Turn to page* 44, *please*)

1946 Crosley



Although it is 28 in. longer, and driven by an engine which is twice as powerful, this new Crosley weighs no more than the prewar model of approximately 1000 lb. Its aluminum body has two seats in front, two in back, and a luggage compartment 25 by 40 in. The engine was described in the Jan. 15 issue of AUTOMOTIVE and AVIATION INDUSTRIES.

More New Car Prices Established by OPA

Ceiling prices for Plymouth, Dodge, De Soto, Chrysler, Nash and Lincoln 1946 model passenger cars have been set by OPA. Four Ford models, not previously priced, have been added to the list. The following official prices, F.O.B. factory, do not include excise taxes, transportation, or preparation and handling charges.

	1946 retail prices	1942 retail prices
Plymouth De Luxe		
4-door sedan	$998	$882
2-door sedan	947	843
3-pass coupe	910	805
club coupe	988	878
Plymouth Special De Luxe		
4-door sedan	1025	928
2-door sedan	985	888
3-pass coupe	951	848
club coupe	1028	921
Dodge De Luxe		
4-door sedan	1086	981
2-door sedan	1043	951
3-pass coupe	980	888
Dodge Custom		
4-door sedan	1145	1041
club coupe	1136	1038
De Soto De Luxe		
4-door sedan	1168	1093
2-door sedan	1138	1065
3-pass coupe	1060	1000
club coupe	1160	1082
De Soto Custom		
4-door sedan	1229	1142
2-door sedan	1203	1132
club coupe	1219	1132
Chrysler Royal		
4-door sedan	1264	1167
2-door sedan	1236	1144
3-pass coupe	1142	1065
club coupe	1261	1158
Chrysler Windsor		
4-door sedan	1352	1244
2-door sedan	1301	1209
3-pass coupe	1204	1129
club coupe	1316	1217
Nash—600 Series		
brougham	1038	961
4-door sedan	1041	971
2-door sedan	987	946
Ambassador Six Series		
brougham	1165	1134
4-door sedan	1179	1144
2-door sedan	1084	1119
Lincoln		
4-door model 73 sedan	1799	1700
club coupe, model 77	1784	1700
4-door custom interior	1915	1795
club coupe custom interior	1900	1795
Ford		
De Luxe eight		
chassis with open or closed end	676	633
Super De Luxe eight		
convertible coupe	1124	1083
station wagon	1170	1118
chassis with open or closed end	744	688

PERSONALS

Recent Appointments Among Automotive and Aviation Manufacturers:

Boeing Aircraft Co., **A. F. Kogan,** Director of Industrial Relations, succeeding C. E. French.

Lockheed Aircraft Corp., **Ronald H. Askew,** Export Sales Mgr.

Consolidated Vultee Aircraft Corp., Stinson Div., **Larry Cooper,** General Sales Mgr.

Culver Aircraft Corp., **Robert R. Nadal,** Sales Manager.

The Cessna Aircraft Co., election of company directors as follows: **Dwane L. Wallace, Thomas B. Salter, Frank A. Boettinger, Will G. Price, Sr.,** and **Getto McDonald.**

United Aircraft Corp., Hamilton Standard Propeller Div., **William P. Huxley,** Asst. Sales Mgr.

Continental Motors Corp., **C. Wheeler Johnson,** elected vice-president in charge of newly organized general service and distributor sales dept. **Palmer A. Dolph,** elected vice-president and asst. sales mgr. of automotive and transportation engine div.

Nash Motors, **James W. Watson,** Eastern regional sales mgr.

Willys of Canada, Ltd., **Charles R. Prout,** General Mgr.

Chrysler Corporation, **A. vanderZee,** vice-pres. in charge of sales, elected a Director.

Chrysler Corp., De Soto Div., **Arthur B. Nielsen,** Eastern Sales Mgr.

Kaiser-Frazer and Graham-Paige Corps., **A. K. Steigerwalt,** Mgr. of Willow Run parts and accessories div.

Kaiser-Fraser Corp., Edgar Kaiser, Vice-Pres. and General Manager.

Ford Motor Co., **E. J. Wedge,** General Supt., Ford Highland Park plant, and **Harold Robinson,** General Supt., Tractor Mfg. and Assembly.

Packard Motor Car Co., **J. R. Ferguson,** Director of Automotive engineering.

General Motors Corp., Chevrolet Motor Div., **J. E. Simmons,** Regional Mgr., Great Lakes Region. General Motors Overseas Group of Operations, **Edward Riley,** Vice-Pres., succeeding **J. D. Mooney.**

United Specialties Company, **H. G. Chandler,** elected Vice-President in Charge of Sales.

Ethyl Corp., **George P. Rosser,** Asst. Mgr., Kansas City Div., **Gerald A. Lofquist,** Asst. Mgr., Chicago Div.

Victor Mfg. & Gasket Co., Directors elected as follows: **Edward Gammie,** Gen. Sales Mgr.; **Adam R. Smith,** Cost Engineer, and **Edward C. Kos Koba,** General Counsel.

Evans Products Co., **Harry S. Finkenstaedt,** elected member of board of directors.

Clark Equipment Co., Celfor Drill and Cutting Tool Div., **L. M. Weaver,** Sales Mgr.

General Motors Corp., New Departure Div., **Eugene E. Gloss,** Service Mgr. of Ball Bearings.

Eaton Mfg. Co., Axle Div., **George W. Veale,** Gen. Mgr.

Sun Oil Co., **Frank R. Markley,** General Sales Mgr.

Spicer Mfg. Corp., Resignation of **Joseph E. Padgett,** as Vice-President.

Joseph T. Ryerson & Son, Inc., **James M. Mead,** Mgr. New York Steel-Service Plant, and **C. L. Hardy,** Mgr. Philadelphia Steel-Service Plant.

Carboloy Co., Inc., **J. E. Weldy,** Mgr. of Distributor Sales; **Harry Crump,** Chief Tool Sales Engineer, and **G. M. Chandler,** Asst. to the Vice-Pres. in Charge of Sales.

Worthington Pump and Machinery Corp., **W. A. Finn,** Export Mgr.

Aireon Mfg. Corp., **J. M. Wherritt,** Mgr. of Emergency Communications Div.

P. R. Mallory & Co., Inc., **Philip R. Mallory,** Chairman of the Board, and **Joseph, E. Cain,** President.

General Electric Co., Aircraft Gas Turbine Div., **H. D. Kelsey,** Mgr. Engineer. Ordnance Div., **C. G. Pommer,** Mgr.

Casco Products Corp., **Lawrence Fenn,** Sales Mgr. for Automotive Accessories; **Wallace Powell,** Asst. Sales Mgr. of Automotive Section; **Herman C. Yellen,** Service Mgr.

Lindberg Engineering Co., **Douglas Rader** has resigned as Advertising Mgr.

The Aro Equipment Corp., **C. W. Ginter,** Vice-Pres.

Norton Co., Grinding Mch. Div., **Clarence I. Smith,** Detroit District Mgr.

Lempco Products, Inc., **George J. Barsa,** Vice-Pres. and Gen. Mgr. of Lempco subsidiary, Lempco Automotive, Inc.

The Reliance Electric & Engineering Co., **Fred E. Harrell,** General Works Mgr., has been elected a member of the board of directors.

Vanadium-Alloys Steel Co., Colonial Steel Div., **Sterling T. Boyd,** Plant Metallurgist.

Formica Insulation Co., **Fred C. Walter,** Asst. Sales Mgr.

United States Rubber Co., Tire Div., **C. L. Wanamaker,** Production Mgr.; Gillette Tire Div., **F. A. Foster,** Merchandise Mgr. in charge of battery, accessory and repair material sales.

United States Rubber Export Co., Ltd., **C. L. Foutz,** Director of Mfg.

Collins & Aikman Corp., **Bruce A. Alexander,** Asst. to Director of Advertising and Sales Promotion.

Hydraulic Machinery, Inc., **Ted Nagle, Director of Sales and Advertising.**

Zenith Radio Corp., **E. R. Taylor,** Director of Advertising.

Cook Electric Co., **James R. Downing,** Director of Research.

The Joyce-Cridland Co., **J. M. Switzer,** Chairman of Board of Directors; **Huston Brown,** President and Sales Mgr.; **Kert Hott,** Vice-Pres. and Secretary; **Warren Webster,** Vice-Pres. and Treas., and **Merle P. Smith,** General Mgr.

Business in Brief

***Written by the Guaranty Trust Co., New York, Exclusively for* AUTOMOTIVE AND AVIATION INDUSTRIES**

The general expansion of business activity continued at the beginning of the new year. The *New York Times* index for the week ended January 5 stands at 132.4, the advance during the period having canceled the sharp preceding decline, and compares with 131.1 for the week ended December 22 and with 154.2 a year ago.

Sales of department stores, as reported by the Federal Reserve Board, for the week ended January 12 were 13 per cent. greater than those in the corresponding period in 1945.

Electric power production during the same week was further increased. The output, according to a preliminary report, was 9.6 per cent. below that a year earlier, as against a comparable decline of 12.7 per cent. in the preceding week.

Railway freight loadings during the week ended January 12 totaled 772,558 cars, 18.4 per cent. above the figure for the preceding week but 1.3 per cent. below that for the corresponding period in 1945.

Crude oil production in the same week averaged 4,578,400 barrels daily, 30,300 barrels above the preceding rate but 2.9 per cent. less than the corresponding quantity a year earlier.

Bituminous coal and lignite production during the week ended January 5, according to the preliminary estimate, totaled 10,125,000 net tons, 42 per cent. more than the output in the Christmas week. Total production last year was estimated at 576,000,000 tons, 7 per cent. less than the output in 1944.

Civil engineering construction volume reported for the week ended January 17, according to *Engineering News-Record*, totaled $45,381,000. Although less than the amount shown for the longer preceding week, this figure is 64 per cent. greater than the corresponding sum last year.

The wholesale price index of the Bureau of Labor Statistics for the week ended January 5 declined to 106.8 per cent. of the 1926 average, as against 107.0 a week earlier and 104.6 a year ago.

Member bank reserves increased $323,000,000 during the week ended January 16. Underlying changes reflected include a decrease of $464,000,000 in Reserve bank credit and a drop of $485,000,000 in Treasury deposits with Federal Reserve banks, accompanied by a decline of $178,000,000 in money in circulation.

Total loans and investments of reporting member banks decreased $110,000,000 during the preceding week. A decline of $7,000,000 in commercial, industrial and agricultural loans was recorded. The sum of these business loans, $7,242,000,000, shows a net increase of $806,000,000 in twelve months.

Ratings for Iron and Steel Suspended, Warehouses Under Voluntary Rationing

All outstanding ratings for iron and steel were suspended by the Civilian Production Administration on January 21, and steel warehouses were placed under a voluntary rationing system to insure delivery of a substantial portion of the nation's current stocks of steel to essential needs.

The suspension of all "AAA," "MM" and "CC" ratings was officially authorized by Dir. 13 to PR 1. Under this direction every order for items of iron and steel bearing a preference rating which has been placed, or is placed during the period of the strike, must be treated as unrated. However, this does not apply to orders on distributors bearing a rating of "AAA" issued by CPA on or after January 21, 1946.

In cases of an emergency where the filling of a particular order for iron and steel is absolutely essential in the interests of the public health or safety, CPA may issue a specific written directive to a producer or distributor requiring the filling of that order from finished stocks on hand. Alternatively, CPA may assign a rating of "AAA" to an order in this type of emergency. This rating will be valid only against stocks of distributors, and may not be extended to producers.

When Dir. 13 is revoked, presumably when the strike is settled, any portion of an order bearing a rating which has not been filled will again be considered rated as if the rating had never been suspended.

The voluntary rationing system was outlined by CPA in a "declaration of policy" issued to steel warehouses. Under this declaration all steel warehouses, fabricators and others with inventories of steel mill products, who are ordinarily in the business of selling such items, are requested to carry out the following policies immediately:

1. For all types and shapes of steel mill products—Ration all deliveries so that no customer will receive more than is needed for immediate use and by so doing stretch stocks to last over the longest period possible for those uses for which the items handled have customarily been sold.

2. For types and shapes of steel mill products ordinarily used for maintenance and repair—When stocks of these products have been reduced to 50 per cent of the normal inventory of such products, deliveries thereafter should only be made for emergency maintenance and repair uses which have to do with public health and safety, such as requirements of hospitals, public utilities and transportation facilities, and for other extremely essential maintenance and repair. This does not include deferrable maintenance and repair nor general maintenance and repair for those industries which will be shut down for other reasons even if they should receive maintenance and repair materials.

The declaration also points out that, "It is manifestly impossible for the warehouses to supply materials in mill quantities to any customers, and industries requiring such quantities for production cannot be kept in operation from warehouse stocks. Emphasis must accordingly be placed on using such stocks for the purpose of taking care of essential maintenance and repair requirements, and supporting the production of repair parts.

"If distribution of existing steel stocks is handled effectively in accordance with the above policies, it should seldom be necessary for the CPA to issue a direction or 'AAA' rating on a warehouse, fabricator or processor to meet specific needs. The CPA would authorize no directions or 'AAA' ratings other than those warranted by extreme emergencies."

CPA Administrator John D. Small in issuing the declaration emphasized that CPA is depending upon the cooperation of steel mill managements, and the local representatives of labor, to make possible the release and shipment from strike-bound steel mills of finished items not available elsewhere and which are needed for emergency purposes. Requests to release steel from such mill stocks will be made only when such shipments have been certified by CPA directives, as necessary to meet serious emergencies in connection with the public health, safety and welfare of the nation.

PUBLICATIONS

The Aviation Dept., Socony-Vacuum Oil Co., has published a new booklet, **Aircraft Lubrication.** The 96-page manual is thoroughly illustrated with detail scale drawings in several colors. A glossary of aeronautical terms is included.*

A new, 4-page booklet on the **personal plane radio** has been announced by the Transmitter Div., General Electric Co. The booklet describes the features of the radio and lists the technical specifications of the unit.*

Hydraulic Press Mfg. Co. has issued a new bulletin describing its line of **H-P-M Hydraulic High Pressure Die Casting Machines.** Included are illustrations of the various models, specifications and descriptive information.*

A new engineering manual entitled **Tailoring in Metal** has been released by The United Welding Co. It discusses factors affecting the choice of welded fabrication and the techniques of welded design. Various types of welds are explained and how they affect static and fatigue load values.*

Ex-Cell-O Corp. has issued a new bulletin on **gasoline injection systems for aircraft engines.** A page is devoted to the ABC's of gasoline injection and a flow diagram and sectional view of the Ex-Cell-O gasoline injection system is given.*

Bendix Products Div., Bendix Aviation Corp., has issued two new folders as follows: 1) Descriptive folder giving details of the new PS Series Stromberg Injection Carburetors for light aircraft. It illustrates six available models of this new carburetor which, it is claimed, incorporates many of the advantages of the Stromberg injection carburetors. 2) Folder relating to the new Bendix Segmented Rotor Brake for airplanes.*

A revised edition of its **Tool Catalog**—GT-175R—has been released by Carboloy Co., Inc. Important changes indicated in the catalog include the addition of several new standard tool-sizes and the fact that Carboloy plug and ring gage bushings are now available from stock.*

Surface Radiant Tube heating is described in a new 4-page bulletin, No. SC-128, issued by Surface Combustion Corp. Application of radiant tubes to various types of heat treatments and processes is covered. The bulletin shows a schematic view of a radiant tube and includes illustrations of some of the types of furnaces in which it is used. Also included is a chart giving the available heat of artificial, natural, propane and butane gases.*

Surface Combustion Corp. has also issued a bulletin describing case hardening in its standard rated furnaces.*

Kearney & Trecker **No. 1H and 2HL Milling Machines** are described in Catalog H13. The catalog illustrates and describes the two machines, gives complete plan dimensions and specifications and also describes and illustrates accessories and attachments for the machines.*

Cincinnati Milling and Grinding Machines, Inc., has issued a general catalog, M-1420, giving information on its milling, grinding, broaching, lapping and cutter sharpening machines. Several new machines are included, and various attachments are illustrated and described.*

Complete data on flexible fuel lines, brass fittings, fuel strainers, dash controls, tube cutters, etc., is included in a new **Imperial No. 22-B Condensed Automotive Catalog** issued by The Imperial Brass Mfg. Co. Also described are the latest Imperial fuel line and fitting merchandisers.*

* Obtainable by subscribers within the United States through Editorial Dept., AUTOMOTIVE *and* AVIATION INDUSTRIES. In making requests for any of these publications, be sure to give date of the issue in which the announcement appeared, your name and address, company connection and title.

Kaiser-Frazer Lease On Willow Run Extended

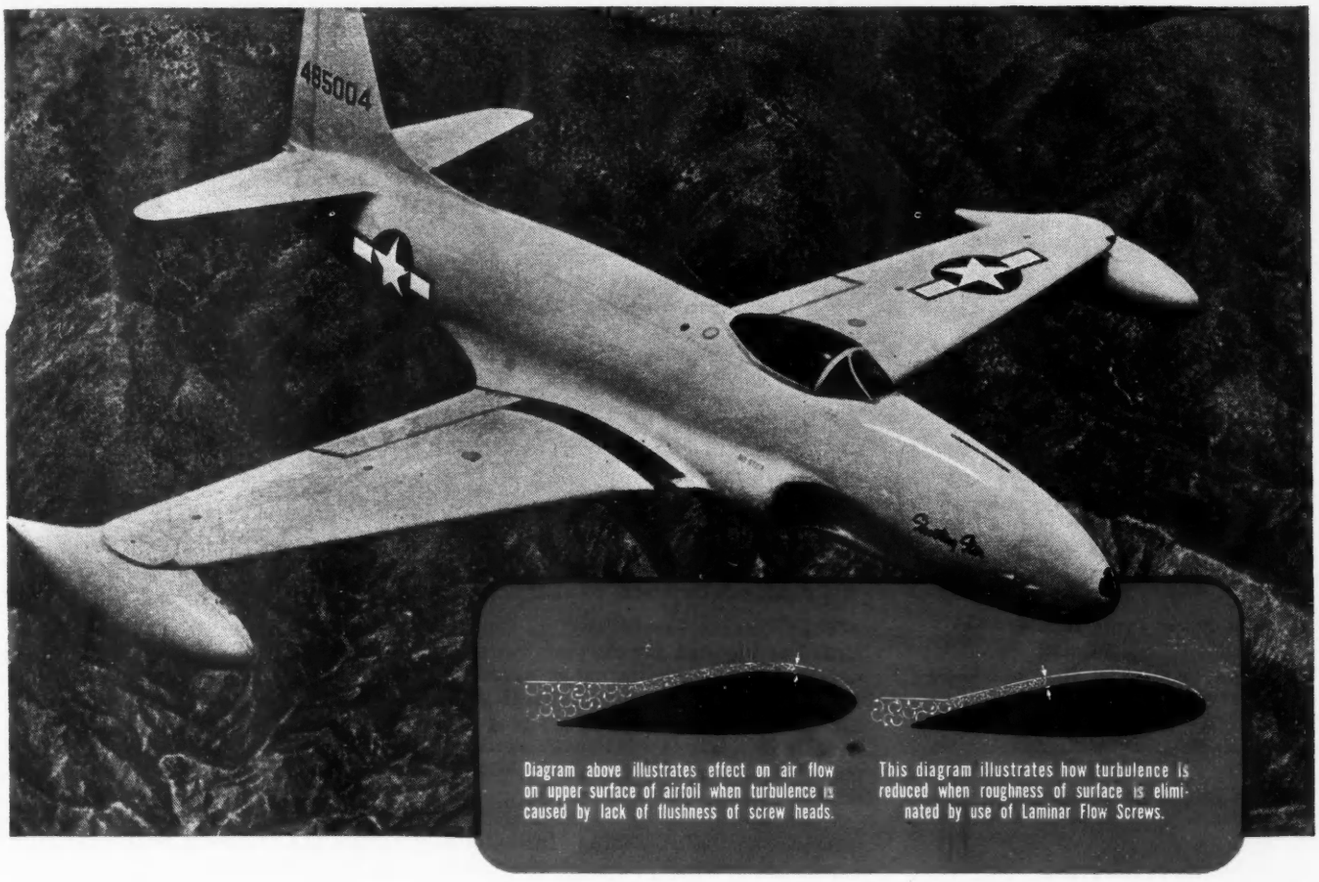
Under a new agreement reached between Kaiser-Frazer Corp. and the RFC, the company may continue to occupy the Willow Run plant for ten years, according to a company statement. The original lease ran only until Dec. 31, 1950. The new agreement grants occupancy until Dec. 31, 1955, provided the company exercises its 5-year extension option by Dec. 31, 1949. Rental is on graduated scale for the first two years. It will be $500,000 in 1946, $850,000 in 1947, and $1,200,000 for each year thereafter. The approximate manufacturing area occupied by Kaiser-Frazer is 2.65 million sq. ft.

Division of Witco is Moved to Detroit

The Automotive Specialties Division of Witco Chemical Co. has moved its headquarters from Chicago to Detroit. G. R. Widger, manager of the Automotive Specialties Division, will handle sales and service from the new office.

Jet Propelled Plane Sets New Speed Record

A new official non-stop transcontinental speed record was set Jan. 26, when a P-80 Army jet-propelled pursuit plane traveled from Long Beach, Cal., to LaGuardia Field, N. Y., in four hours, 13 minutes and 26 seconds. The distance was 2470 miles and the average speed 584.6 mph.



WHEREVER FLUSH-HEAD SCREWS ARE USED,

LOCKHEED adopts *"Laminar Flow"*

National HEADED AND THREADED PRODUCTS

On exposed surfaces of fast planes, ordinary screws cause turbulence in air flow—and cut down speed. For the Lockheed Shooting Star, the trimmest and smoothest plane yet produced, "National" engineers developed true flush-head screws which have been adopted as standard by this great aircraft manufacturer.

The special method which we devised for producing Laminar Flow Screws and holding them to the extremely close tolerances required* is typical of National Technical Service. Please consult us about this or any other fastener subject.

*"Laminar Flow" screw heads will check from flush to a minus of .004" maximum on screws up to ¼" dia. and .005" on screws of $\frac{5}{16}$" and $\frac{3}{8}$" dia.

THE NATIONAL SCREW & MFG. CO., CLEVELAND 4, O.

CALENDAR

Conventions and Meetings

American Society for Metals, Cleveland-Natl. Metal Show — Feb. 4-8

American Society for Testing Materials, Pittsburgh Spring Meeting — Feb. 25-Mar. 1

Pan-American Aircraft Exposition, Dallas — Mar. 1-5

Second Northwest Annual Airshow, Minneapolis — Mar. 12-18

The Amer. Helicopter Society, Phila. — Mar. 14-15

Amer. Soc. of Mechanical Engineers—Spring Meeting, Chattanooga — Apr. 1-3

American Management Association, Atlantic City, N. J., Packaging Exposition — Apr. 2-5

SAE Natl. Aeronautic Meeting, New York, N. Y. — Apr. 3-5

Midwest Power Conference, Chicago — Apr. 3-5

American Society of Tool Engineers, Cleveland Tool Engineers Exposition — Apr. 8-12

International Lighting Exposition, Chicago — Apr. 25-30

The Chamber of Commerce of the United States — Annual Meeting, Atlantic City — Apr. 30-May 2

Natl. Assoc. of Corrosion Engineers, Kansas City, Mo., Annual Meeting and Convention — May 7-9

Associated Business Papers, Hot Springs, Va., Spring Meeting — May 22-25

SAE Summer Meeting, French Lick, Ind. — June 2-7

Amer. Soc. of Mechanical Eng.—Detroit — June 17-20

SAE Natl. West Coast Trans. and Maint. Meeting, Seattle — Aug. 22-24

SAE Natl. Tractor Meeting, Milwaukee, Wis. — Sept. 11-12

Public Misunderstands Profits of Industry

The public has a peculiar misconception of profits made by the automotive industry, a recent nationwide survey made by a national public opinion research company shows. The average individual questioned thought the industry made about 24 per cent profit, with some guesses ranging as high as 31 per cent. Actually, profits for the industry averaged less than 4 per cent on sales in wartime and less than 8 per cent in peacetime, according to the Automobile Manufacturers Association.

Asked what they thought would be a fair net profit for the industry, the average individual thought an average of 12 per cent would be about right. Motor vehicle manufacturers, after taxes, averaged a 5 per cent return on sales in 1942, and 3 per cent in 1943 and 1944. In the peacetime years of 1939-41, the average was 7.8 per cent on sales.

Mack Plans High Output Of Trucks During 1946

Mack International Motor Truck Corp. plans to build between 22,000 and 25,000 trucks this year if labor conditions throughout the industry do not interfere, according to George W. Borthwick, vice president. He said the company is in a fortunate position to reach its goal, since a large proportion of its truck components are manufactured in its own plants. Mack has on hand enough orders to run six months, with every indication of peak production after that. The company will allocate its production to as many future owners as possible, rather than to accept orders for large quantities from individual purchasers so long as production does not meet demand.

British Firm Licensed To Make Formica Materials

The Formica Insulation Co., Cincinnati, has planned for further overseas development by negotiating an arrangement with De La Rue Insulation, Limited, London, England, whereby the British company is being licensed to manufacture Formica decorative materials.

Under the terms of the licensing arrangement, De La Rue Insulation, Limited is licensed to manufacture, sell and distribute the decorative materials in The United Kingdom, The Commonwealth of Australia and New Zealand, Africa, and South Africa, India and all other parts of the British Empire other than those situated in the Western Hemisphere.

Advertising Notes

Carl Byoir & Associates, Inc., has announced the election of Gerry Swinehart, since 1943 executive vice-president, as president to succeed Carl Byoir. Mr. Byoir will become chairman of the board of the public relations organization, which he founded in 1930.

George Hammond, former New York newspaper man who joined the company in 1932 and has been a vice-president since 1943, succeeds Mr. Swinehart as executive vice-president.

The organization, which has maintained offices in New York, Chicago and Washington, has opened a Pacific Coast office in Los Angeles under the direction of Charles E. McVarish.

Edward Donovan, former member of the advertising department, Frigidaire Division of General Motors, has joined the copy staff of Ross Roy, Inc., Detroit agency.

David O'Connor, formerly of Chicago where he was active in public relations work for the last ten years, has joined the Detroit office of the Fred Eldean Organization.

The McLain Organization, advertising and sales planning organization, Philadelphia, has announced the appointment of John O'Hara Harte as director of public relations and plans.

With the appointment of Mr. Harte, the 38-year-old McLain organization also announced the formation of a public relations department to service its clients, as well as additional outside business.

McCann-Erickson, Inc., New York, has been appointed to direct the domestic national advertising of Pan American-Grace Airways, Inc.

Steel Strike

(*Continued from page* 40)

been so fortunate and if several are forced to stop production for lack of steel and if inventories of the particular part are not large, as is the case in many instances, automobile production will go down before the manufacturer's own supply of steel is exhausted.

At Packard, where assembly lines had been down for three weeks, 1000 workers were recalled about the middle of January and production was resumed. Production during the last half of the month, however, was erratic, with output varying from 50 to 200 cars a day. A transmission bushing which had been the chief shortage, now again is in good supply, but engine bearings still are troublesome and likely will continue so until the end of the G.M. strike. When production was resumed, the company had on hand about 1000 bodies from Briggs. Hudson sees no immediate trouble on the steel situation, although a spokesman admits that a prolonged strike would shut down the plant. The company had been experiencing some difficulty on glass and in some cases had to shorten shifts that were directly affected by the shortage.

Another New Car Maker

(*Continued from page* 40)

welded in much the same fashion that aircraft fuselages are built. Light metals or plastics would be used for the body, which would be constructed by use of new processes which permit forming of large shapes without requiring expensive dies. The driver's seat is said to be in the center for better vision, with swinging single seats on either side.

While principals in the deal, other than Tucker, have not been announced at this writing, they are reported to include a well-known Chicago millionaire, a former production head for a large Detroit automotive manufacturer, and a truck sales manager from another automotive company. It should be remembered, of course, that all plans so far announced are tentative both as to structure of the company and design of the product. Additional and detailed information will not be available until more phases of the organization have been shaken down.

Check these Features of

VICKERS

Variable Delivery PISTON TYPE PUMPS

Among the features indicated below are many of the reasons for the high overall mechanical efficiency and the high volumetric efficiency of Vickers Variable Delivery Piston Type Pumps. Also, the inertia forces of the rotating parts are minimized . . . the cylinders are arranged axially permitting more compact design.

Write for new Bulletin 43-11 which includes description of construction, operation and types of controls, installation drawings, performance characteristics, installation and operating instructions of Vickers Variable Delivery Piston Type Pumps.

VICKERS *Incorporated*
1428 OAKMAN BLVD. • DETROIT 32, MICHIGAN
Application Engineering Offices
CHICAGO • CINCINNATI • CLEVELAND • PHILADELPHIA • LOS ANGELES
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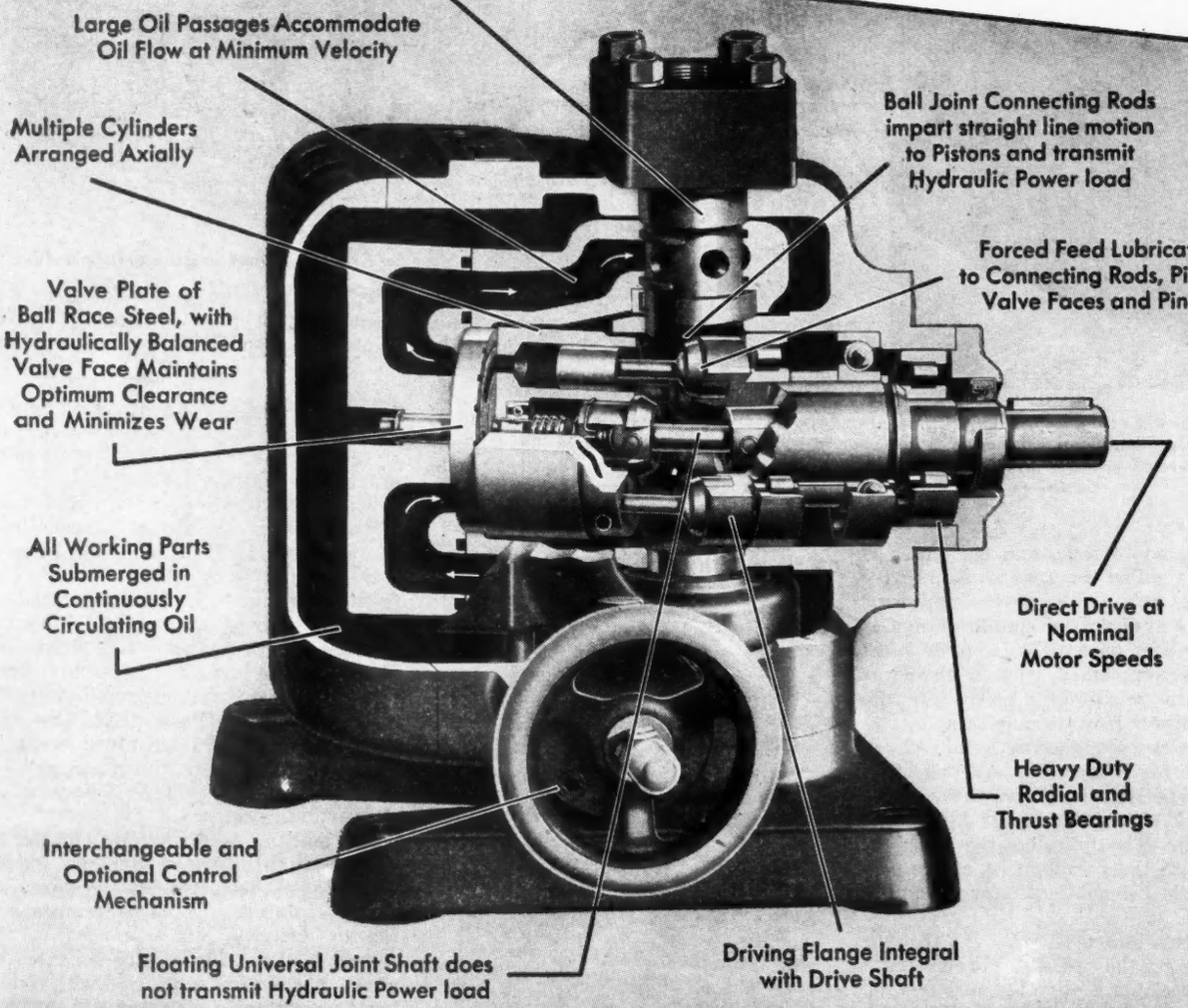
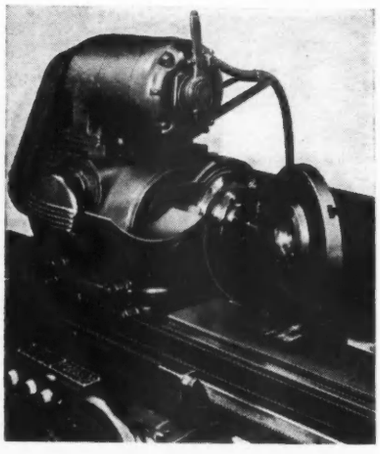


There Are More Than 5,000 Standardized VICKERS Units For Every Hydraulic Power and Control Function

New Production Equipment

A NEW headstock has recently been applied to the line of hydraulic universal grinding machines built by Cincinnati Grinders, Inc.

Of major interest is the adoption of a modified lathe standard spindle nose, which permits standard chucks and face plates to be mounted without intermediate adapters. Dimensions conform substantially to American Standards, sizes 5 in. type for B1 for 12-in. machines and 6-in. type B1 for 14-in., 16-in. and 18-in. machines, with the following exceptions; the number of threaded holes for mounting chucks and face plates has



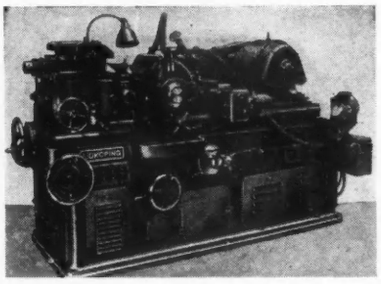
New headstock for Cincinnati grinding machine showing construction of spindle nose and face plate

been reduced to four, and the taper is slightly smaller to assure a positive "squaring up" action of the chuck or face plate against the spindle flange.

The greater part of live spindle work will be accomplished with a chuck or face plate mounted directly on the spindle nose. However, it may be desirable to remove the work and chuck as a unit for inspection. An operation of this type may be accomplished with the "quick change" adapter applied to the chuck. The unit has the same dimensions as the spindle nose, and is provided with L-head bolts for clamping it thereto.

Another improvement is in the mounting of the spindle. It now runs on two precision adjustable anti-friction bearings, one at the front and one at the rear end, with a single accessible adjustment at the rear.

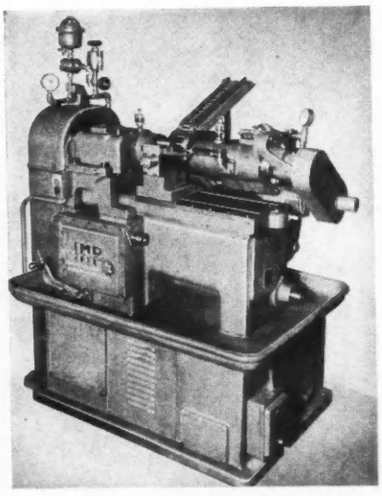
LIDKOPING MEKANISKA VERKSTADS A. B., Sweden's largest machine tool manufacturer and a division of the S. K. F. Ball Bearing Corp., is introducing a centerless grinding machine in four sizes. Triplex Machine Tool Corp. of New York City has been appointed agent.



Lidköping centerless grinder

Lidköping centerless grinders are of heavy construction and have both grinding and regulating wheel spindles supported by bearings on both sides of the wheels. A through-feed speed of 100 fpm and stock removal of 100 lb per hr are said to have been obtained in the grinding of steel shafts. Lidköping grinders can be used for through-feed grinding and for in-feed (plunge-cut) grinding. Both wheels are provided with adjustment relative to the work. A wide variety of attachments is available for profile grinding, feeding of short pieces, grinding of bars and tubes, twist drills, etc.

Hosepower rating of the grinding spindle drive motor on the No. 3A machine is 15 hp, 25 hp on the No. 4A, 50 hp on the No. 5A and 90 hp on the No. 6A grinder. Grinding wheel sizes accordingly range from 16 in. diam by 6¾ in. width to 30 in. diam. by 16 in.

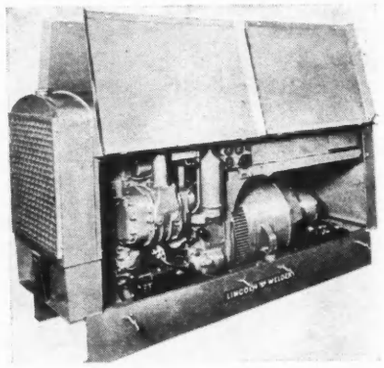


Double-end drive automatic IMP lathe

POWERED by a two-cycle Diesel engine, a new welder of 300-amp capacity specially made for use in locations where electric power is not available, or not economical, is announced by the Lincoln Electric Co., Cleveland, Ohio.

Equipped with dual continuous control, this Lincoln welder permits the operator to select any type of arc and any arc intensity to suit the job. Other features of the welding generator include separate excitation and laminated magnetic circuit for a smoother, more productive arc at all current values.

The welding generator has N.E.M.A. rating, 300 amp at 40 volts. Current range for welding duty is from 20 to 40 volts, 60 to 375 amp. Dual control of welding current is accomplished by adjustment of both series and shunt fields. Uniform welding current is supplied for metallic arc welding in any position with bare or heavily coated electrodes, also for carbon arc welding.



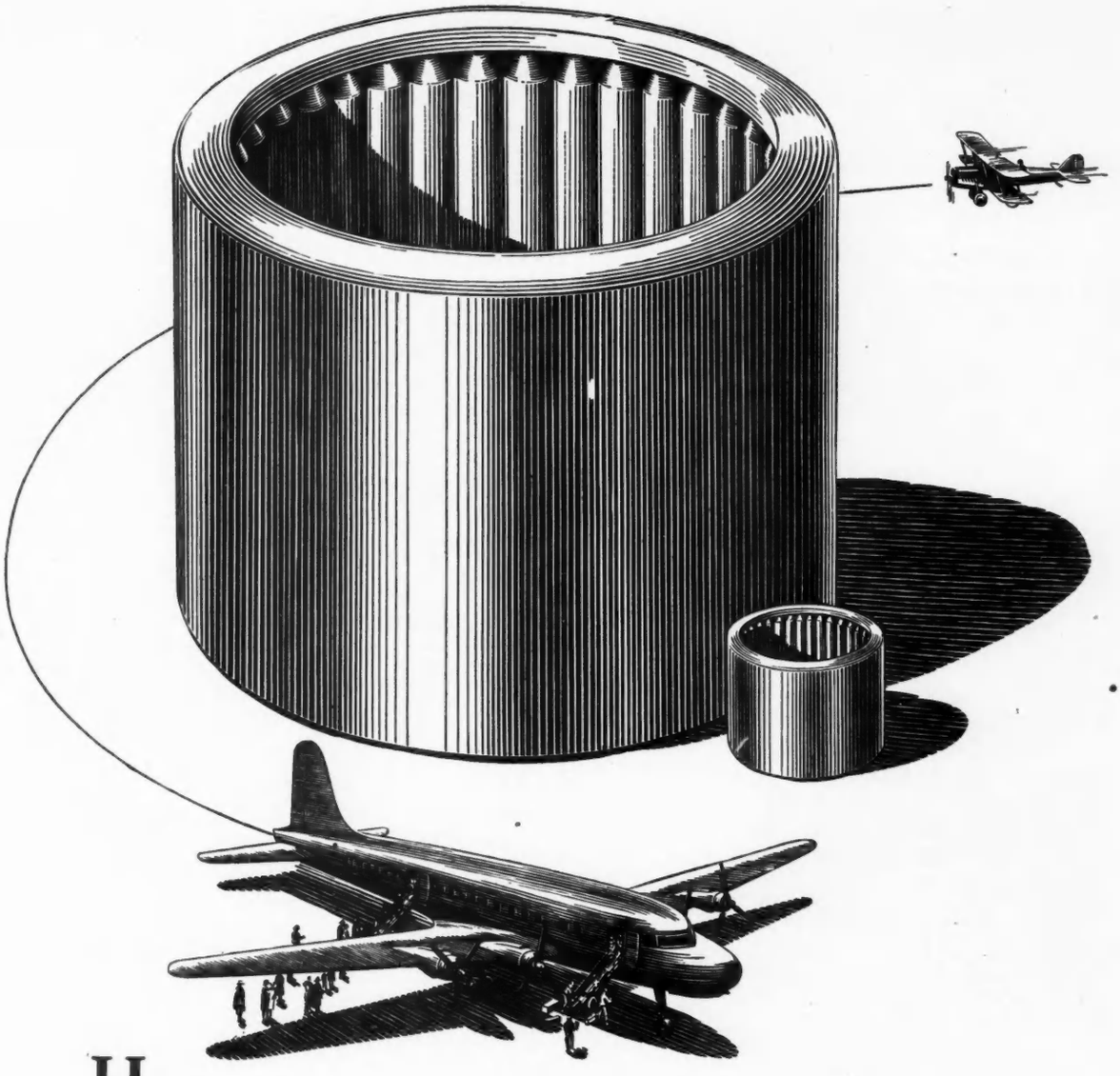
Lincoln Diesel engine driven welder

THE Seneca Falls Machine Co., Seneca Falls, N. Y., has developed a new method for automatically turning valve guides and similar parts.

The illustration shows a front view of the new, double-end drive, completely automatic IMP lathe. The drive to both spindles is by pulleys and V-belts from a splined jackshaft extending along the rear of the machine. The advantage of this double-end drive for work of this type is two-fold; first, since the piece is driven from both ends, much coarser carriage feeds are possible, thereby considerably increasing production; secondly, inasmuch as both spindles are driven, there is no wear on the revolving centers.

The machine is entirely automatic. In the machine illustrated valve guides which have been previously bored to size are placed in a loading chute and fed by gravity into openings in the rotary loader. The loader indexes the pieces to the proper position where they are automatically picked up by the continuously revolving spindles of both heads. The slots in the rotary loader are slightly larger than the rough parts, thus permitting sufficient clearance for them to revolve while held between centers.

(*Turn to page* 85, *please*)



Here's One Way to Pack More Payload* into Your Product...

Weight-reduction is important in many fields other than aircraft . . . in fact, it's the order of the day in design of machines, tools, appliances and handling equipment.

That's why the weight-saving, space-conserving features of anti-friction Torrington Needle Bearings are so important. For the full complement of small diameter needle rollers gives a tremendous radial load capacity in an extremely small and compact unit. Furthermore, the bearing is designed for mounting in the simplest type of housing—a bore machined to proper dimensions . . . and installation is a simple press-fit operation.

These features, contributing directly to weight-and-space-saving designs, are enabling many manufacturers to increase the payload* of their products by improving the "*operating efficiency-weight ratio.*"

Let us give you the full story of Needle Bearing advantages in terms of your own design requirements. Considerable engineering and application data are available in the Torrington Needle Bearing Catalog No. 32, furnished upon request. Our engineering department will be glad to work with you on any specific design or application problem.

THE TORRINGTON COMPANY

TORRINGTON, CONN. SOUTH BEND 21, IND.

Offices in All Principal Cities

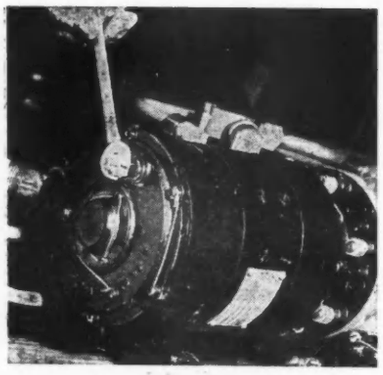
TORRINGTON NEEDLE BEARINGS

New Products for Aircraft

Lightweight Starter for Jet-Propulsion Turbines

To start such jet-propulsion turbines as the 19B, a 10-hp lightweight starter has been engineered by the Westinghouse Electric Corp. The job of this starter is to bring the compressor and turbine rotor from standstill to at least 2000 rpm in about 15 seconds. The starter is rated at 10 hp, 17 volts at 6000 rpm (it uses a 4 to 1 gear) but develops 18 hp at peak output. The rating is on a 30 second basis. Even so the weight is only 31 pounds. A multiple-plate friction clutch is interposed between the motor and the jaw engagement to enable most rapid starting with safety.

The starter gets its power from the plane's 24-volt batteries. To obtain



Westinghouse lightweight starter

maximum power with least drain on the battery, the motor was designed with impedance to match that of the battery and circuit. Since the inrush current is approximately 1800 amp a serious commutation problem had to be overcome, and was solved by the use of a special grade of halide-treated brush. So critical is the performance of the starter to brush type that a change in brushes may change the available peak output from 8 to 18 hp.

Instrument Indicates Maximum Allowable Airspeed

A maximum allowable airspeed indicator, known as the Army-type F-4, has been developed by Kollsman Instrument Division of the Square D Co., Elmhurst, N. Y. The instrument provides warning when a plane approaches critical speeds that are a threat to control and structural limitations.

The F-4 safe airspeed indicator has two hands, a red one which indicates the maximum allowable airspeed and a white pointer which shows the plane's indicated airspeed. Thus a pilot needs only a glance to see that the speed registered by the white hand never exceeds that indicated by the red.

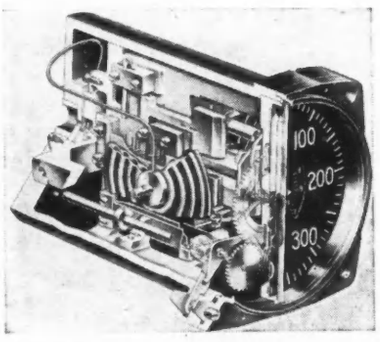
The instrument's mechanism automatically and continuously computes the ratio of the plane's airspeed at various altitudes to the speed of sound. It has an adjustment which is set according to the speed at which shock wave phenomena would occur on a specific airplane.

Instrument System Provides Directional Accuracy

An electrical system of instruments announced by General Electric's Meter Division will give an airplane sustained directional accuracy, except for wind drift deviations, in flights controlled by autopilots without the necessity of gyroscope corrections being made by pilots or navigators. The advanced system, known as the compass-controlled directional gyroscope, functions in giving exactly correct and continuous data on directions when the plane is being manned by a new pilot.

In the new G-E system the compass and gyroscope are harnessed into a steady computing unit through an electrical coupling. The result is that errors which normally would crop out in either of those instruments operating separately are corrected automatically.

Gyroscopes operating by themselves drift slightly from a set course during airplane flight primarily because of the relation of the gyro to the earth's rotation. This means that gyroscopes not teamed electrically with the compass must be reset slightly at intervals by the pilot. The impulses from the compass in the new G-E system do this automatically.



Cutaway view of the Kollsman maximum allowable airspeed indicator

Another factor of minor error in autopilots operating without the new system is that the compass vibrates slightly, with the needle flicking back and forth over the true directional line. When those vibrations are balanced, the compass line is accurate. However, an autopilot answering the compass direct-

G-E compass-controlled directional gyroscope system

ly tends to edge off the predetermined line of flight of the plane at fractional angles.

The new system of co-ordinating through an electrical coupling of the compass and gyroscope is said to eliminate both of those errors.

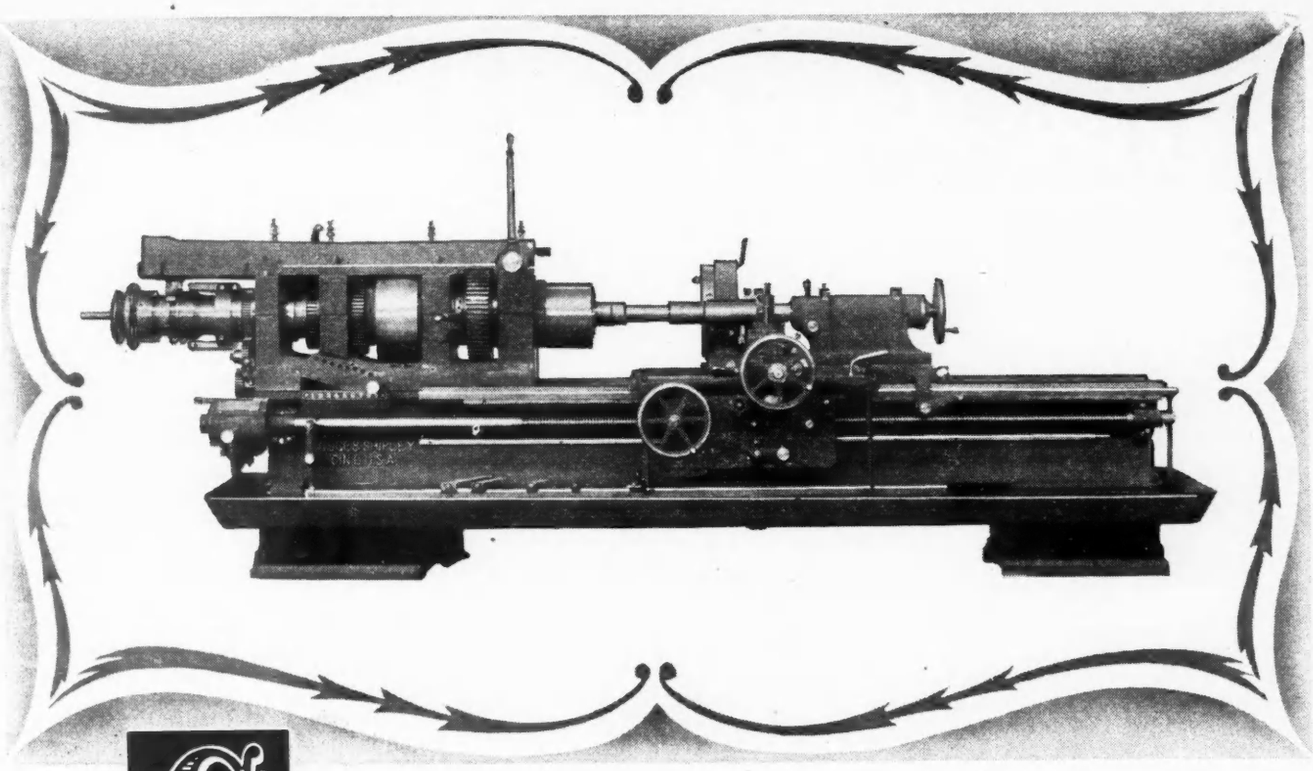
Endurance Record for Stratosphere Flight

A specially-equipped, high-altitude B-29 superfortress at Boeing Aircraft Co. in Seattle, Wash., has established what was believed to be the endurance record for stratosphere flight by heavier-than-air-craft.

The record of three hours and 38 minutes at an altitude over 40,000 feet was made in conjunction with high altitude flights being conducted by Boeing and the Air Technical Service Command to test various types of equipment for future stratosphere bombers. Total time of the flight from takeoff to landing was four hours and 59 minutes. Lowest outside temperature recorded in the pressurized flying laboratory at the high altitude was -86 F.

American Brakeblok to Build Canadian Plant

The American Brakeblok Division of American Brake Shoe Co. plans to manufacture automobile and industrial brake lining material in a new plant to be built at Lindsay, Ontario. Approximately seven and one-half acres of land between the Canadian Pacific Railway and Colborne Avenue have been purchased in Lindsay, and present plans call for the construction of an 80-ft by 300-ft factory on this property It is estimated that the building and equipment will cost approximately $350,000. The Lindsay plant will manufacture a complete line of brake lining for use in buses, heavy and light trucks, and passenger cars. Friction material for industrial applications also will be manufactured.



CAN A 1920 LATHE *meet today's shaft job demands?*

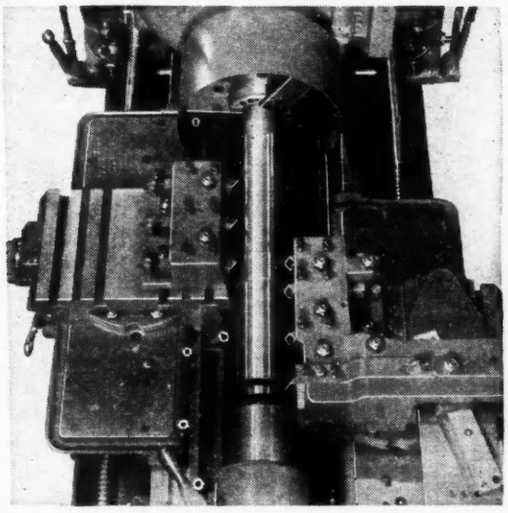
● "Sure this lathe is 25 years old. It's still running, isn't it?"

It may be running, but the real question is: *How well does it perform?* On a shaft job, for instance—how does a 25 year old "antique" stack up against a lathe built this year?

On the old model, it takes plenty of time with only one tool on the job. Traverse is returned by hand, so more time is lost. It requires a skilled operator to produce with accuracy and some degree of speed.

Compare these old lathes with a new 2A or 3A Duomatic—L & S full automatic lathes. View at the right shows seven tools turning three diameters and chamfering end of the shaft simultaneously. An unskilled operator on a Duomatic accurately turns out dozens of shafts automatically, while the old lathe turns one.

You can save time and money, meet the keenest competition if you're well equipped. One Duomatic can likely replace several of your "antiques" or war-weary lathes. Investigate now! Call on L & S Engineers for a complete analysis of your lathe problems. There is no obligation.



On the Duomatic, multiple tools can be used to full advantage, in turning and in straight and angular facing operations. It's like two lathes in one. Dual tool slides—front and rear—operate singly or together, permit a wide range of cycles never before possible. Write on your company letterhead for detailed Bulletin No. 601.

THE LODGE & SHIPLEY MACHINE TOOL CO.

L & S LATHES

CINCINNATI 25, OHIO, U. S. A.

MACHINE TOOL DIVISION 3055 COLERAIN AVE. • SPECIAL PRODUCTS DIVISION 800 EVANS ST.

New Products

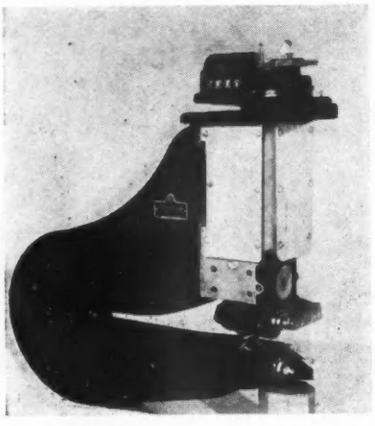
Electrolimit Continuous Gage with Deep Throat

To meet the rolling industry's requirements for a continuous "flying mike" which will reach in farther on the rolled strip material than standard gages, Pratt & Whitney, West Hartford, Conn., offers the Model D-10 Electrolimit continuous gage.

This gage has a throat depth of 10 in., which makes it possible to measure to the center of strip material up to 19 or 20 in. in width. With narrower strip material, this gage will allow the full width of the strip material to be measured.

The deep throat casting can be assembled at the factory to any standard Model D Gage. This unit then can be assembled to the present designed mill mountings where the rail is mounted vertically.

The Model D-10 differs from the Model D only in the depth of the throat and the main casting. All other parts are interchangeable.



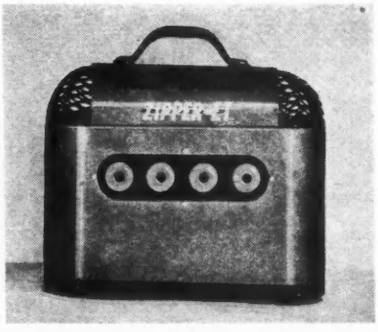
P&W continuous gage

The P&W Electrolimit continuous gage, under conditions of constant temperature, is accurate to .000025 in., but as the temperature changes such as it does in rolling, the gage reading varies from its original setting and this variation is actually a shift of the zero setting. A temperature compensator is available that maintains a zero setting, namely, counter on zero and meter on zero—for all conditions of temperature, and this then makes the gage indication accurate for any setting thickness, whether the gage is cold or warm.

A P&W remote control unit, when combined with the P&W Electrolimit continuous gage, will allow remote control operation. The handwheel setting knob on the gage head is replaced by a reversing Selsyn motor and worm gear drive. The counter, which indicates the gage setting on the head, remains undisturbed.

Welder for Light-Duty and General Maintenance Work

A small, portable electric welder which is sold under the trade name Zipper-Et, is now being delivered by Mid-States Equipment Corp., Chicago, Ill.



Zipper-Et portable electric welder

It operates on 110-volt alternating current and has separate primary and secondary transformer windings, thus eliminating the need for a polarized type of plug and special care in welding grounded objects, such as water pipes, radiators, etc.

The entire Zipper-Et, complete with all accessories, is self contained and has a total weight of approximately 40 lb. Accessories include cables with insulated taper plugs and sockets, a separate electrode holder and ground clamp, and aluminum, brazing and steel rods together with starting carbon. Also included as standard equipment is the 9000 Arc Torch that provides an electric flame.

Many Precision Gages Assembled from Small Kit

The DoALL Co., Minneapolis, Minn., has brought out a new gage kit, named the "Producto-Chek." It consists of a number of instruments to be used in conjunction with gage blocks for quickly setting up practically any type of inspection gage. A few examples of these are the dial indicating snap gage, plain bench comparator, dual bench comparator, angle comparator, square comparator, precision height gage, depth gages, and a series of go-no-go snap gages of any size up to eighteen in. Plug gages and internal gages of any size in steps of .0001 in. can be made up from the set. In addition, gages such as hole to hole, hole to base, parallel bore gages, pitch diameter, and many others can be made up for special applications. A set of holders from 2 to 18 in. in length are designed to carry the gage blocks. Besides the hand held gages that can be formed, a whole series of bench and surface plate gages can be assembled by using the base block, master flat or numerous other attachments.

Producto-Chek gage kit

In addition to the usual types of gages, there are several unusual ones. One of these is an indicating snap gage incorporating a dial indicator. Another is an internal gage incorporating a dial indicator. Then, there is an angle comparator using two dial indicators, which is set with a sine bar. Included also in the kit is a multiple bench comparator that makes two measurements simultaneously.

Another instrument of the kit is an indicating square check gage. With this, the work is placed on a master flat and is simply pushed against a back stop; a dial indicator showing instantly whether or not the angle is 90 deg. A feature of the kit is a set of "wires" of various diameters. These are lapped to the accuracy of gage blocks and are used direct as plug gages or in caliper jaws where square jaws could not function or where combination square and round caliper jaws are needed. Although it is used in conjunction with gage blocks and in some cases a surface plate, the kit itself does not include these items.

The Producto-Chek gage kit weighs 40 lb and is housed in a hardwood box 10 in. by 20 in. by 4 in.

New Device Introduces Air Into Exhaust Systems

A new type of accessory claimed to improve fuel economy, provide smoother engine operation while running and idling, and a factor in producing cleaner combustion chambers has been introduced by DeLuxe Products Corp., LaPorte, Ind.

The DeLuxe Clear-Ex (Clear Exhaust) is a simple automatic air valve which introduces air into the exhaust system of internal combustion engines. Attached to the exhaust manifold, it operates by utilizing vacuum which exists in the exhaust system. It is designed to clear the burnt gases remaining in the combustion chambers after the ex-

(*Turn to page 52, please*)

The CONE AUTOMATIC MACHINE COMPANY sees many GOOD THINGS AHEAD

Photo Courtesy Pantex Pressing Machine, Inc.

It is reported that . . . . . .

One of the country's largest corporations announces that it will build a million-dollar plant for the making of prefabricated houses. Plans call for the starting of production about the middle of 1946, and capacity will be 1650 per year. *U. S. Steel Corp.*

get ready with CONE for tomorrow

A large chemical company promises to build a million-and-a-half dollar plant for the production of synthetic caffeine. The raw materials will be air and water. *Monsanto Chemical Co.*

get ready with CONE for tomorrow

During the war, the principle of mass production was applied to the making of marine chronometers, increasing the output from 400 a year to thousands. *Hamilton Watch Company.*

get ready with CONE for tomorrow

One of our leading technical colleges is planning to establish a gas turbine research laboratory which will include a supersonic wind tunnel and special facilities for the study of compressors, combustion devices, jets and other gas turbine elements. *M.I.T.*

get ready with CONE for tomorrow

Indication of industry's increasing use of the multiple spindle automatic is the recent announcement of the new five-spindle machine built by Warner & Swasey.

get ready with CONE for tomorrow

In a new radio-phonograph set the radio unit can be readily removed and used separately. *Westinghouse.*

get ready with CONE for tomorrow

A new mechanical cotton picker is designed to take advantage of the recently developed method of defoliating the plant by means of a chemical spray. *Charles R. Berry, Vicksburg, Miss.*

get ready with CONE for tomorrow

An optical company announces the development of a light-polarizing glass. Previous polarizers have been made of natural crystals or plastic film. *American Optical Co.*

PRODUCTION TIME = $\frac{\textit{CYCLE TIME}}{4}$

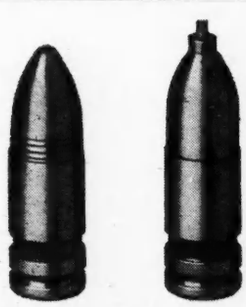
on the Vertical Conomatic

The Vertical Conomatic job shown here consists of a second operation where all four spindles are hopper-fed. A single operator produces 6,500 pieces per eight-hour shift — an average work cycle of 14 seconds—an average part production of 3½ seconds!

Although Vertical Conomatics can produce *4 like parts* during every cycle, they can be used to advantage for producing *dissimilar parts* during each cycle, within certain dimensional limitations.*

It will pay you to investigate the possibilities of the Vertical Conomatic on your own work. Write for details.

*** Consult Cone for particulars.**



CONE

AUTOMATIC MACHINE CO., INC. ★ WINDSOR, VERMONT, U.S.A.

25

haust stroke and to replace those gases with fresh air.

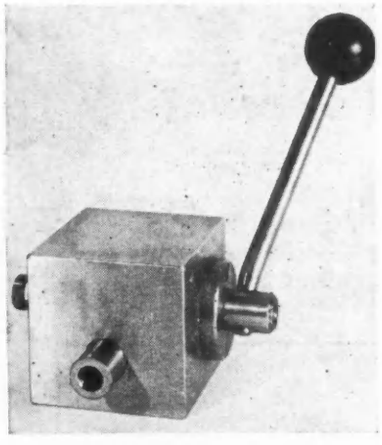
At full engine load, Clear-Ex permits fresh air to enter the exhaust manifold. A vacuum ram created by inertia draws air through the Clear-Ex after each pressure wave of the exhaust. The air thus admitted is said to find its way into the cylinder through the exhaust valve by means of the same vacuum ram.

At deceleration it is said to permit air to be drawn directly into the cylinders because there is a vacuum in the cylinder when the exhaust valve opens. This is claimed to facilitate the complete burning of carbon monoxide gas and to dilute the carbon dioxide gas which would otherwise be trapped in the combustion chambers at the start of the intake stroke.

Usually two of the valves are installed in the exhaust manifold system in holes to be tapped for the purpose. On engines having two exhaust manifolds or cars such as Buick with compound carburetion, it is necessary to use two complete assemblies, although benefits have been obtained with the use of only one set.

New Fixture Clamp and Unit Added to Cone-Lok Line

The Woodworth Cone-Lok fixture clamp and the Woodworth Cone-Lok unit are now available as additions to the line of Woodworth adjustable



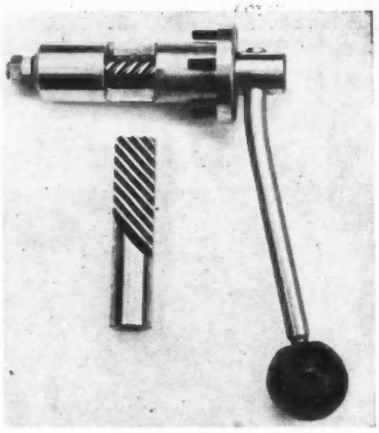
Cone-Lok fixture clamp

clamping jigs produced by N. A. Woodworth Co., Ferndale, Mich.

The Cone-Lok fixture clamp is a self-contained clamp applicable to the great majority of clamping operations with which machine designers are concerned.

The fixture clamp, which is manufactured in three sizes, employs the Cone-Lok mechanism. This consists of male cones which are formed on the pinion shaft and which fit closely with female cones integral with the housing.

This fixture clamp is finding numerous applications for holding work, such as in milling operations. Movement of the plunger is possible only by action of the operating lever. Work is said to be positively clamped at any location desired in the stroke of the plunger.



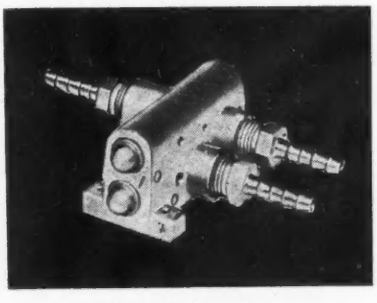
Cone-Lok unit

Plunger travel on the small size clamp is ¾ in., on the medium size clamp 1-1/32 in. and on the large size 1¾ in., these figures being based on 180 deg. travel of the operating lever. Specially designed clamps of extra length travel will be manufactured on request.

Th Woodworth Cone-Lok unit also is manufactured in three standard sizes. The unit consists of rack, pinion, bushing and lever and is intended for the purpose of adaption to fixtures and machines of special design. In order to apply the unit it is only necessary to bore two straight holes of the proper diameters through the jig or fixture, insert the rack plunger in one hole and insert the bushing in the other hole. The bushing is locked in place by four socket head cap screws supplied with the unit.

Air Valve of Simple Design and Construction

A combination three-way or four-way air valve of simple design and construction is now in production at Mead Specialties Co., Chicago, Ill. No filter is necessary with the new valve as it has no sliding closures subject to injury by particles of foreign matter introduced through the air line. The air seals are of the poppet type, lined with synthetic rubber. Only 1/16 in. movement of the two hardened cam followers is required to operate the valve from full open to full closed.



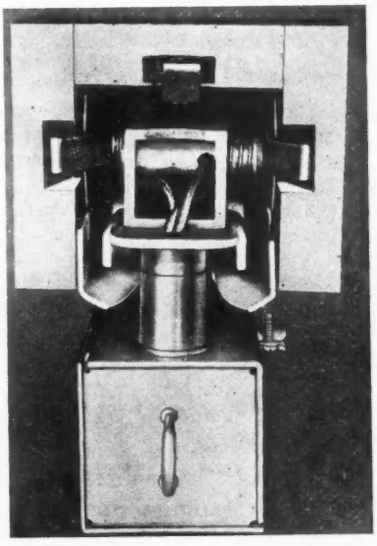
Mead air valve

Transfer Type Trolley for Crane and Hoist Switching

Bulldog Electric Products Co., Detroit, Mich., has modified its duct design and has brought out a new transfer type trolley for crane and hoist switching and transfer.

The claim is made that these provide a safe and more efficient means for transferring loads mechanically and electrically from crane bays to individual factory areas; monorail transfer and switching is also made easier and more flexible.

This is accomplished by electrical transfer trolleys with swiveled heads



Cross sectional view of flared end Trol-E-Duct and transfer type trolley inserted in duct

moving through duct runs having flared ends to facilitate juncture with and transfer to similar runs in adjacent factory bays.

In these installations straight or curved runs of electrical Trol-E-Duct are attached to and move with the

(*Turn to page 67, please*)

Safer Cut-Off Wheels

Bayflex wheels incorporating abrasive in a cotton fibre bonding are a recent development of the Bay State Abrasive Products Co., Westboro, Mass. These cut-off wheels for non-ferrous metals are said to combine great safety with fast, free cutting action. The flexibility of the new bonding material permits side grinding and close following of contours.

1945 Airline Operations Establish New Records

OPERATIONS of the 24 domestic and international airlines of the United States broke all records in their history for the year 1945, according to a review prepared by the Air Transport Association of America. All categories of traffic registered unprecedented gains over 1944, ranging from 57 per cent in revenue passenger miles to about 39 per cent in ton miles of express and freight. The increase in civilian operations occurred during the period while the commercial carriers were still partially engaged in contract war operations for the Army and Navy both in this country and overseas. The period also covered the beginning of extensive contract carrying in the redeployment of troops across the country in Operation "Trans-Con."

The number of planes in the domestic airline fleet reached the total of 402 as of Dec. 15, as compared with the pre-Pearl Harbor peak of 359, with scores more in process of reconversion and other new models coming off the production lines. The overseas fleet totalled 100 planes, giving a total of 502, which was due to exceed 600 as the year closed. But the aircraft were still insufficient to handle the steadily increasing demand for seats, particularly on the eastbound transcontinental trips when in December the Army and Navy temporarily took over 70 per cent of the eastbound space for returning soldiers and sailors. Passengers were looking toward the early months of 1946 when the flow of planes on order will reach substantial volume and bring the total fleet to more than 1414 planes, seating 58,284 passengers, before the end of the year 1946.

The records for 1945 compiled by the Air Transportation Association were based on the latest carrier reports plus a proportionate estimate for the final period on which returns had not been tabulated. The principal categories for the domestic airlines are as follows for 1945:

Revenue passenger miles: A total of 3,525,619,866 as compared with 2,246,894,489 for 1944, an increase of 56.9 per cent.

Revenue miles: A total of 219,169,459 as compared with 144,240,440 for 1944, an increase of 51.9 per cent.

Revenue passengers: A total of 6,621,842 as compared with 4,575,716 for 1944, an increase of 44.7 per cent. Toward the end of 1945, as more planes were becoming available, the increase in number of passengers was running higher than 62 per cent over the corresponding period in 1944.

Ton-miles of mail: A total of 72,231,126 as compared with 51,143,837 in 1944, an increase of 41.2 per cent.

Ton-miles of express and cargo: A total of 24,505,243 as compared with 17,694,988 in 1944, an increase of 38.4 per cent.

The record was substantially raised with the addition of the performance of the international United States flag lines. No comparison with last year is available because of war restrictions. Including estimates for the opening of new Atlantic and Pacific routes toward the close of the year, the approximate extent of the overseas operations for 1945 is revealed as follows:

Revenue passenger miles: 493,000,000; Revenue miles: 32,000,000; Revenue passengers: 460,000; Ton-miles of mail: 4,625,000; Ton-miles of express and freight: 8,336,000.

The network of air routes for the transportation of passengers, airmail, and cargo in the United States was increased by 4,034 miles. The total number of route miles which the airlines were authorized to fly by the Civil Aeronautics Board reached the all-time high of 66,971.

The average number of seats rose to 19.2 and the airline personnel to more than 50,000. Fares had been reduced to 4½ cents per mile, while a reduction of 13 per cent in basic express rates was announced, effective Jan. 1, 1946.

Still with insufficient equipment, the airlines were able to handle as much traffic as they did through continued maintenance of the exceptionally high utilization of aircraft achieved during the war. As compared with 7 to 9 hours before Pearl Harbor, planes in service during the later months of the war were flown 11 to 12 hours daily. This figure has dropped slightly on some lines, but has actually been improved on in others, at least two recording a 12½ hour daily average use.

Similarly the war-time load factor, which hit a high average mark of 92 per cent, has dropped somewhat, but three lines actually increased theirs. One line operated in the vicinity of 95 per cent of available seats filled with paying passengers and several held over the 90 mark. The international U. S. carriers were operating at better than an 80 per cent load factor, with average journeys of close to 1000 miles.

The performance of planes took a big leap as war needs ended. There began to be available aircraft capable of 300 miles an hour speeds, as compared with the prewar 180 mile an hour models. Capacity was rising to 50 or more seats, while pressure cabins were due to raise comfortable "over the weather" cruising heights to 30,000 feet.

During the latter part of the year, in addition to their regular civilian operations, the airlines under contract and through seat allotments helped speed the movement of about 126,000 troops. During the earlier part of the year the air carriers completed their direct war job, which all told amounted to flying 8,000,000,000 passenger miles and 850,000,000 ton miles of cargo under contract for the Army and Navy and in war-tinged civilian operations. On Army and Navy missions alone the commercial carriers flew the equivalent of 26,000 times around the world at the Equator.

Would Allow Germany to Produce Light Cars and Trucks

Adopting a more moderate tone than that of the Technical Industrial Disarmament Committee, the Foreign Economic Administration in its final report on German economic and industrial disarmament has recommended that the German automotive industry be permitted to produce limited numbers of passenger vehicles and light trucks. Production of heavy trucks and military vehicles would be prohibited.

FEA which was recently absorbed by the State Dept. formulated its recommendations to conform with those advanced by the minority of the Committee. The majority recommendation was that automotive manufacturing in Germany be prohibited altogether.

Recognizing that the war potential of the motor vehicle industry lies in its availability for conversion to mass production of a wide variety of military products, the report points out that the quantitative production of military and combat transport vehicles is only secondarily significant.

By 1937 standards, the German automotive industry is not comparable with that of the United States. During that year Germany produced 269,000 passenger cars and 62,100 trucks compared with 3,915,000 passenger cars and 893,100 trucks for the United States. However, the German capacity has been greatly expanded during the war years

(*Turn to page* 103, *please*)

ONE FINGER is all it takes

to start, stop, or reverse the spindle

. . . and this is a 50 h. p. headstock!

Yes, it's as easy as this with Gisholt's new Hydraulic Spindle Control. Just touch this handy lever...hydraulic power engages and disengages the forward and reverse multiple disc clutches. When the control lever is in neutral, pressure is directed to a contracting band-type brake which brings the spindle to a quick, smooth stop. Thus, headstock control is effortless—as easy as pushing buttons!

The Gisholt 5L Saddle Type Turret Lathe shown below is an extremely powerful machine with a 50 h.p. headstock. Yet it requires surprisingly light operating effort. Another outstanding example of Gisholt leadership in faster, lower cost machining, the Gisholt hydraulic spindle control is now available *on all* Gisholt Turret Lathes. Write for complete information.

Look Ahead . . . Keep Ahead . . . with Gisholt Improvements in Metal Turning

GISHOLT MACHINE COMPANY

1205 East Washington Avenue • Madison 3, Wisconsin

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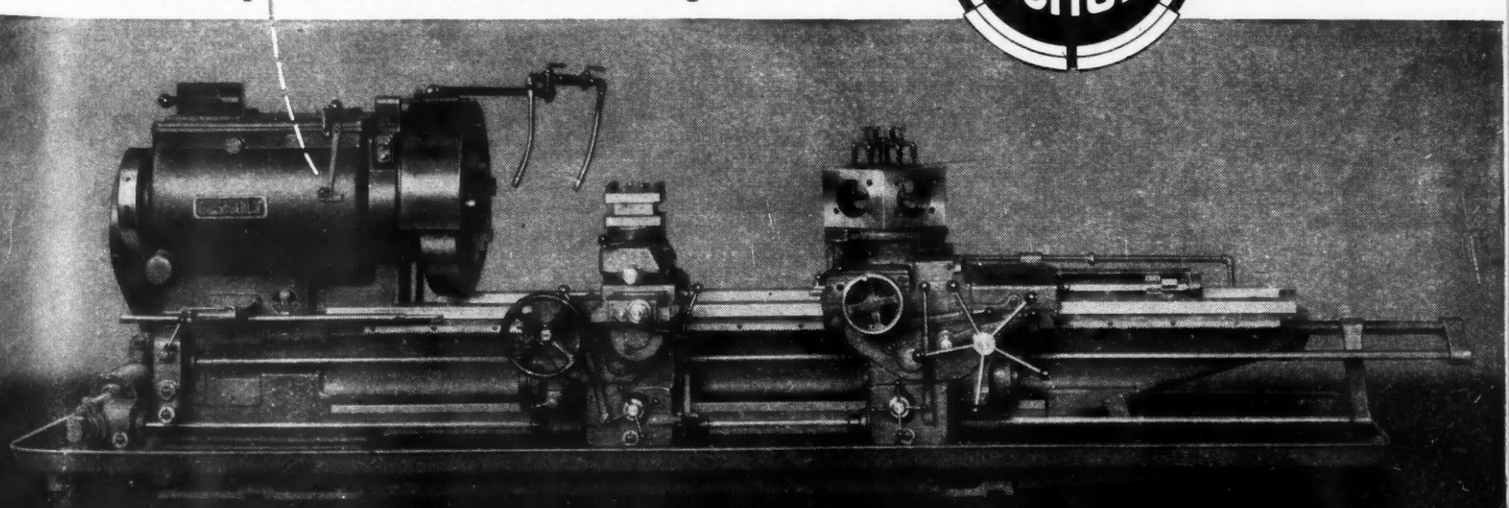

TURRET LATHES • AUTOMATIC LATHES • SUPERFINISHERS • BALANCERS • SPECIAL MACHINES

Velocity Band Sawing

(*Continued from page* 21)

few plastic applications, are now cut at velocities of from 2500 to 5000 fpm. The new type saw is of course a part of the new technique, and should be given preference. As to pitch, one may apply the following general recommendations and save both time and unnecessary saw wear:

Saw Pitch	Thickness
6-pitch	up to ½ in.
6 or 4-pitch	½ in. to 2 in.
4 or 3-pitch	2 in. to 4 in.
3 or 2-pitch	4 in. and over

To establish the most efficient velocity for plastics, it is advisable to start with 4000 fpm as a maximum for a thickness under ½ in. and decrease this velocity by 200 fpm for every ½ in. increase in thickness to 6 in. plus. It is obvious that some intermediate thickness of this ½ in. step, with some plastics, may demand a decrease or increase of 100 to 200 fpm to either improve the finish or obtain a higher cutting rate. However, this formula will help to develop the correct saw control factor in the least possible time.

If the high velocity application is any kind of wood, plywood and most any so-called builders' board, it is safe to apply a formula based on 4500 fpm as a maximum for 1 in. stock or under, and step this down 300 fpm for every inch thickness increase of 6 in. plus. When cutting wood, the new type band will not slow up for mineral streaks and will, at the proper velocity, produce a planer-type finish.

Additional non-metals well adapted to high velocities, are sponge and hard rubber, paper laminates, carbon, dry ice and many others.

In relation to the light metals, such as aluminum and magnesium alloys, the new type saw at high velocities has given remarkable results as to increased cutting rates, higher finish and accuracy of cut. This is particularly true with the trimming of excess material and cutting gates and risers from light metal castings. High velocities for these materials vary from 3500 fpm for a thickness under ¼ in. down to 2500 fpm for most any thickness over 1½ in. A material thickness under ⅜ in. should preferably be cut with a standard saw of from 8 to 14-pitch, increasing the pitch, of course, as the thickness decreases.

Such alloys as lead, babbitt, brass, copper and silver cut substantially faster and cleaner at high velocities than conventionally. Saw speeds vary from 4000 fpm for less than a ¼ in. thickness, down to 3000 fpm as a minimum for any other thickness. The standard pitch saw should also be selected for cutting any of these materials in the thinner sheets; otherwise select the special course pitch saw.

Now we come to that stage when the saw travels so fast and the material is so hard that the operation turns from high speed sawing to friction sawing. The latter is not new as accomplished by the disk method, but with the high-speed contour sawing machine it surely is. Both techniques are efficient and each has its particular or unique advantages.

True enough we have yet far to go, much to learn and above all we should be most careful not to exaggerate the potential limitations of band saws in this respect. However, there are facts deserving recognition and they are of timely importance.

Primarily, we can now friction band saw, and most economically if the thickness is under ½ in., the carbon, free-machining, National Emergency, manganese, nickel, molybdenum, chromium, tungsten and silicon steel alloys. Also included in the friction sawing group of materials are armor plate, stainless steels, cast steels, gray cast iron and malleable cast iron.

With friction sawing, tooth sharpness is not a controlling factor as with actual sawing, because the saw reaches its peak of efficiency only after

(*Turn to page* 60, *please*)

WESTERN *Felt*

Can Serve You In Countless Ways

Check these possible uses in your production:

- Excluding dirt, grit, dust
- Retaining lubricants
- Thermostatic insulation
- Isolating vibration
- Cushioning shock
- Electrical insulation
- Weight reduction
- Temperature maintenance
- Padding, packing, seals
- Air and liquid filters
- Gaskets, channels, etc.
- Grinding, polishing, etc.
- Instrument mounts

Felt parts for these aviation and automotive uses are readily processed in an unlimited variety of shapes and sizes. Whatever your specifications—Western Felt can be engineered to fit them—from rock hard to wool soft. Western Felt is an extremely versatile material that is superior in many qualities for parts applications.

Resilient, flexible, compressible—Western Felt has high resistence to oil, water, heat and age. It finishes to very close tolerances . . . and holds its shape perfectly without fraying or ravelling. New uses are discovered daily. Why not investigate felt's profitable possibilities—today?

Western Felt Works engineers are ready to help you select the right felt to match your specific needs.

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it has cut for 20 to 30 minutes. The cutting rate depends entirely on how fast sufficient heat is generated through friction of the saw on the material, to cause the metal in contact to soften sufficiently and be carried out by the teeth.

To friction saw, the pitch must neither be too fine nor too course, and research has established 10- to 18-pitch as most practical. Based on material thickness, recommendations are 18-pitch to a ⅛ in. thickness; 14-pitch from ⅛ in. to ¼ in. and 10-pitch from ¼ in. to ½ in.

Velocities for friction sawing vary from 3000 fpm to 15,000 fpm, depending on thickness and analysis of material (see table 2). However, friction sawing demands an increase in velocity as the thickness of material increases, or in other words, a reverse of the conventional rule. This is logical enough because the more material in contact with the saw teeth, the more speed required to provide additional frictional heat.

The carbon, manganese, free-machining, nickel and molybdenum steels friction cut efficiently at 3000 fpm on a thickness of ⅛ in. and under 5000 fpm on a ⅛ in. to ¼ in. thickness and 12,000 fpm on a ¼ to ½ in. thickness. Relatively speaking, velocities are increased to 5000-12,000-15,000 fpm to cut the chromium, tungsten, NE and silicon-manganese steels. Armor plate, stainless steels and cast steels respond well to velocities of 3000-9000-13,000 fpm. While the cast irons also require 3000 fpm as a minimum up to a thickness of ⅛ in., 5000 and 7000 fpm are respectively recommended for the ¼ in. and ½ in. thickness limitations.

Although ½ in. is the practical limitation from a viewpoint of complete efficiency, it is not the possible limitation. Many of the steels listed above, up to ¾ in. and even 1 in. thickness, may be friction cut with a substantial increase in cutting rate over the conventional procedure. In this case, the application of a so-called trick of the trade is what does the work. The material is brought against the saw and is slightly lifted so only the top edge is presented to the saw teeth. The saw therefore reacts as it would to a much lesser thickness and will keep on cutting quite well by alternately lowering and raising the piece in course of the process.

Cutting rates of as much as 20 linear inches on ½ in. materials and in excess of 60 linear inches on ¼ in. materials are current production records (table III) and worthwhile considering against conventional sawing limitations for relative thicknesses.

Warner Robins Plant Methods

(*Continued from page* 27)

appearance and reveals defects in white. From this line the pistons go to the ring-lapping unit. Five lapping machines are used. Two assembly lines for cylinders are operated when the overhaul section is processing C-type R-2800 engines.

Cylinders are numbered in sets for assembly and like the pistons, are delivered to Final Assembly in complete sets. Two small lines handle reconditioning of rocker boxes, one for covers and one for rocker arms. Placed in special carrying boxes by the set, they are sent to the paint unit, and thence to the cylinder assembly line.

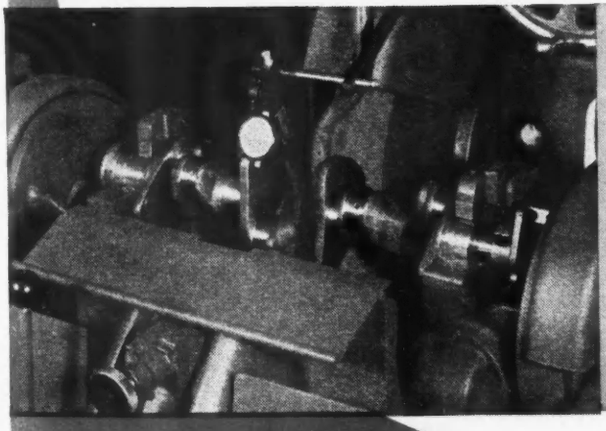
Between Parts Repair and Subassembly is the Stock Pool, where the trucks, each loaded with a section of an engine, are lined up awaiting movement into Subassembly. Besides filling orders for replacement parts when the trucks arrive in the Stock Pool, this unit handles parts to be processed outside the production line. Bearings go to a unit in another building and all parts requiring plating are transported to that unit also in another building. Plated parts include the accessory shaft, thrust plate, knuckle-pins and crankshaft bolts. Replacement parts for engines going through the Stock Pool are drawn from Local Issue and all shortages shown on the check lists are made up before the

(*Turn to page* 64, *please*)

How Design Features of Landis Tool Grinders *Reduce Costs* and give *Closer Tolerances*

Automotive Crankshaft grinding experience is typical

16″ x 42″ Type D Hydraulic Crank Grinder



Crank in Grinding Position with Visual Sizing gauge and crank carrying fixtures

HIGH PRODUCTION FEATURES

Hydraulic Rapid Infeed
Multi-function Control Lever
Hydraulic feed, traverse, workclamp.
Single setup for grinding all pins

PRECISION FINISH FEATURES

Microsphere Wheel Spindle Bearings
Dynamically Balanced Rotating Parts
Massive Wheelbase
Multiple V Belt Drive

LANDIS TOOL CO., WAYNESBORO, PA.

trucks are released to Subassembly.

Subassembly builds up the power, blower, and nose sections on three assembly lines. A fourth line, following the three main subassembly lines and adjoining Final Assembly, handles the assembly of small parts for these sections in 17 operations. The parts include the clutch, oil pumps, spring-drive for the rear case, selector valve assembly, auxiliary fuel accessory drive and the engine fire extinguisher system. Build-up of the three main sections is accomplished in a total of 35 operations —14 on the power section assembly line, 12 on the blower section line and nine on the nose section line.

Special stands, devised by WRATSC engine men, are used on the crankcase line permitting progressive build-up of the power sections without removal from the stands and making possible the use of chain hoists and vises to install the crankshafts. Each power section going through the line is assembled on one of these stands. The frame is constructed from 12 angle irons with a 30 in. by 16 in. sheet of boiler plate welded perpendicularly across the top center of the stand. The boiler plate has a semi-circular space cut to accommodate the crankcase center section. Clamps on the cylinder hold-down studs bolt to the engine stand ring allowing the section to rotate on the stand, thus making any part easily accessible. The ring is split for mounting the center section, and rotates in flanges of the boiler plate. After crankshaft ends are built up, the assembly is removed from the stand for the run-out test, without removing the mounting ring. Prior to adoption of the special stand, crankcases were assembled on work benches.

Regular portable engine mounts are used on the blower section assembly line. Crankcase sections are transferred to these mounts when the three sections are united at the end of the Sub-assembly lines. There they are met by trucks bearing a complete set of cylinders, the assembly line for which adjoins Subassembly.

Final Assembly completes the build-up of the engine. An average of 30 engines are in the Final Assembly line daily, including a backlog of four. Now operating with a total of 26 operations to complete an engine in approximately 35 man-hours, the assembly line had as many as 32 operations for wartime production with engines moving every 18 minutes. Principal assembly operations are the installation of the nose section, the cylinders and pistons, rocker arms and covers, push rods and housings, fire extinguisher system, primer lines, oil sump and scavenger systems, distributor and magnetos, and ignition harness. Also included in these operations, is torquing the cylinder hold-down nuts, valve-timing and clearance adjusting, and safety wiring.

Manifolds and ignition harness are fed to Final Assembly from Miscellaneous Repair to which they were sent by Disassembly and Cleaning on the tear-down. Magnetos, which are from an outside department, likewise go directly to Final Assembly. Baffles, intake pipes and deflectors are received from Sheet Metal Rework unit and stocked in bins which parallel the line.

All bolts, nuts and washers are separated on the tear-down. Those which require plating are sent out to that unit and afterwards are taken to the parts bins by stock tracers. Three-day stocks of these items are maintained on the line. Final operation before an engine is released to engine test, is the preoiling with heated oil injected by an electric pump and heating unit.

Number of Chrysler Dealers Increasing

At the end of 1945, Chrysler Div. of Chrysler Corporation had 3045 dealers on its roster and about 50 more had been accepted but not yet formally franchised, according to Stewart W. Monroe, general sales manager. This compares with 3404 dealers in December, 1941, and with 2481 in December of 1943, the low point during the war.

New Products

(*Continued from page* 52)

crane and hoist equipment to furnish a safe, smooth and speedy means of transferring or switching material to or from any part of a factory.

Alundum Abrasive for Wet Tumbling Operations

Alundum abrasive is now being marketed by Norton Co., Worcester, Mass., in a special form for use in wet tumbling operations. It is a hard, heavy, tough and fast-cutting aluminum oxide product said to be excellent for cleaning, deburring, finishing, and the development of radii on a wide variety of metal parts. The abrasive is available in four size groups—¼ to ½ in., ½ to ¾ in., ¾ to 1 in., and 1 to 1½ in. diameters, either untumbled or tumbled.

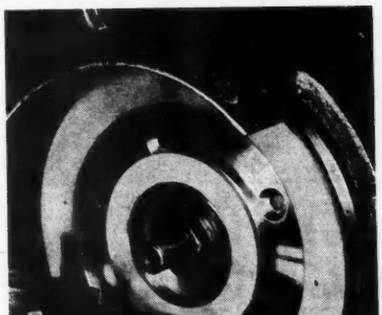
Abrasive Disks for Portable Sanding Units

Departing from the conventional form of a single layer of abrasive particles on cloth or paper, the New York Grinding Wheel Corp., Brooklyn, N. Y., has produced an improved type of abrasive disk for metal-finishing for portable sanding units.

A strong homogeneous, flexible mass is produced by curing together three layers of materials—a bonded cutting layer, a cloth layer, and a fibre disk. A rubber compound is used to bond the abrasive particles, producing a bonded layer ⅛ in. or more in thickness of grit. The second layer is a cloth of high

(*Turn to page* 68, *please*)

Diamond Honing Wheel



The Precision Diamond Tool Co., Elgin, Ill., has put on the market a metal-bonded diamond cup wheel to be used as a diamond honing wheel. The new cup wheel is made in 3-in. and 4-in. diameters and 500 mesh. It mounts on the inside of the 6-in. or 7-in. diamond cup wheels used on standard carbide tool grinders. After grinding on the large wheel, the operator can produce a fine cutting edge with a few strokes across the honing wheel, using the same protractor set-up.

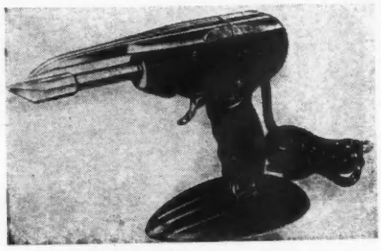
tensile strength, the third a several-ply tough fibre material. The three layers are held together by cement.

These abrasive disks are manufactured in any diameter up to and including 18 in. Manufacture of larger diameters is now being contemplated. Any desired bore can be furnished. the standard thickness is 5/32 in. Thicker disks can be supplied upon request.

Electric Soldering Iron With Automatic Feed

An automatic-feed, electric soldering iron, the Eject-O-Matic, is being introduced by the Multi-Products Tool Co., Newark, N. J. This new iron is trigger operated and ejects a measured amount of solder from a reel concealed in the handle. A special retracting feature prevents the melting of excess solder on the heating tip. The actual amount of solder deposited each time the trigger is pulled is regulated by a micrometer adjusting wheel mounted in the handle of the iron. If, during the course of a job, more, or less solder is required, a touch of the wheel changes the amount ejected.

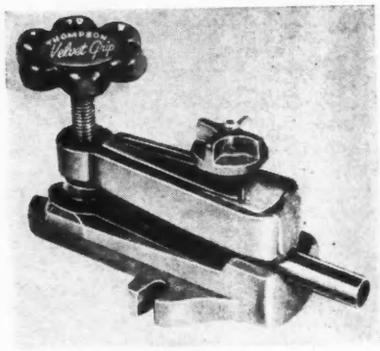
The handle is provided with a two-section, slide-on cover. The shorter section provides access to the loading chamber. The longer section houses the feeder mechanism. This section also incorporates a long grooved channel through which solder is conducted to the heating tip.



Eject-O-Matic soldering iron

Vise for Piston Pins and Other Cylindrical Parts

A special "Velvet Grip" vise that holds piston pins, spindle bolts and other cylindrical parts without distortion or scuffing is being manufactured

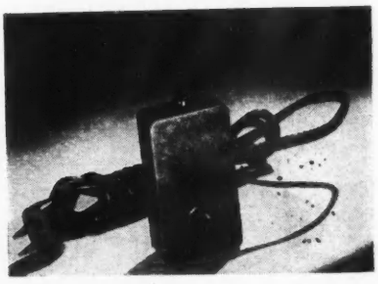


Velvet Grip vise

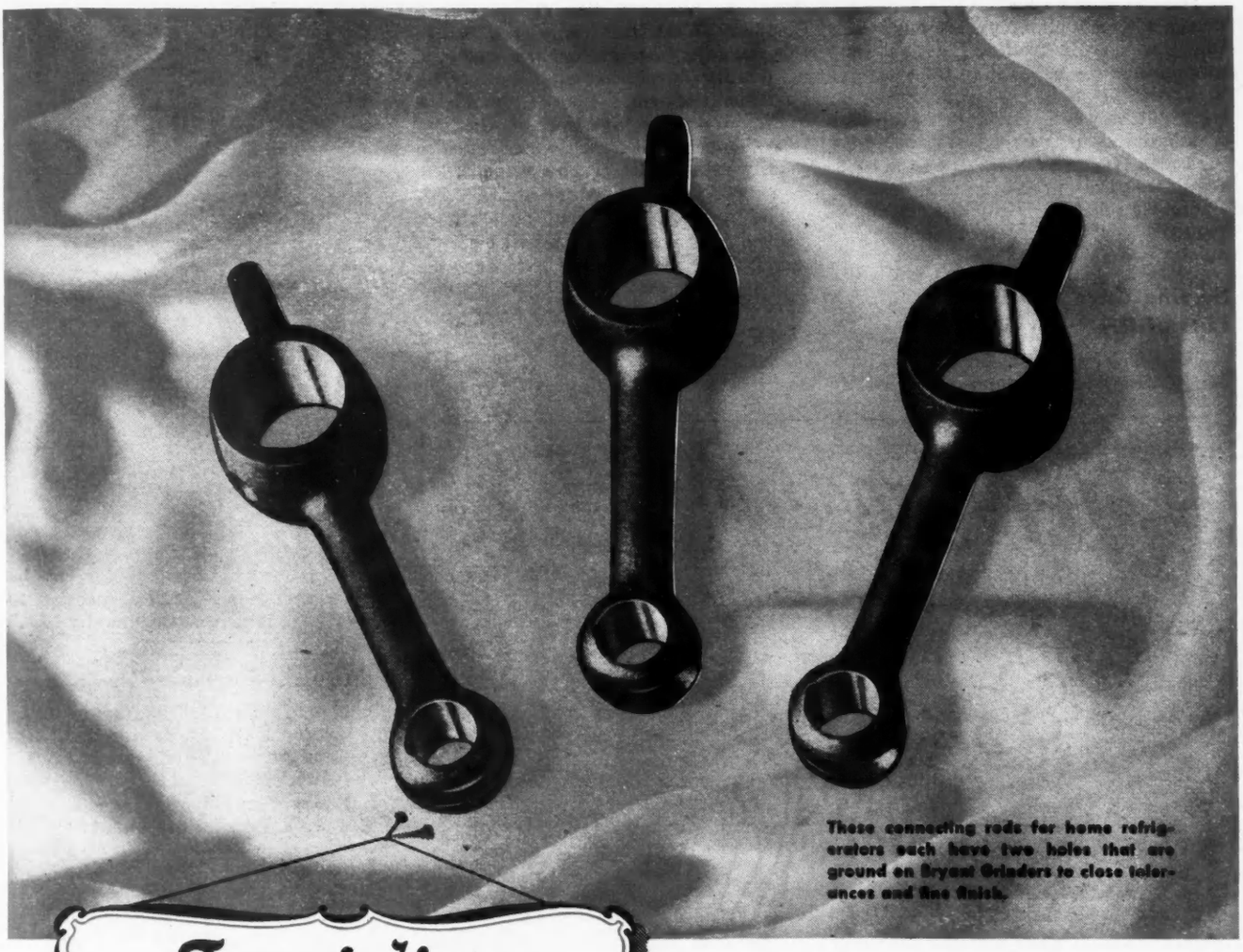
by Thompson Products, Inc., Cleveland. The tool handles diameters from ⅜-in. to 1⅝-in. and may be bolted to the bench or held in a standard machinist's vise.

(*Turn to page* 70, *please*)

Grayhill Demagnetizer



This demagnetizer for small tools with a diameter of 7/16 in., or less, is made by Grayhill, Chicago, Ill. The unit is 3 in. by 1¾ in. by ¾ in. and operates from 115-volt alternating current. To demagnetize a tool, such as a small drill, the coil is energized and the tool is passed completey through the hole of the demagnetizer, and the coil is not de-energized until the tool is approximately 6 in. away from the unit.



These connecting rods for home refrigerators each have two holes that are ground on Bryant Grinders to close tolerances and fine finish.

Specialists in Forged Steel Jewelry

No, we don't sell it; we don't make it, but we do build internal grinding machines that make it. The three connecting rods for home refrigerators, shown above, are typical examples of the type of work that is ground on Bryant Internal Grinders. They are truly jewel-like in their finish, but that is not enough—to be sure, Bryant Grinders produce metal parts that have surfaces finished correctly to millionths of an inch, when desired, but Bryant machines also produce these same parts with holes that are truly round and straight. These are basic elements that Bryant insists upon to assure Bryant users that their parts and products will last for years without mechanical failure.

WE KNOW YOUR PROBLEM IS DIFFERENT . . .

. . . practically every internal grinding problem is different. But when you require extreme accuracy or high production, *or both*, your first step should be to study your problem with a man who makes it his business to solve them. Your first step should be to—

Send for the Man from Bryant!

BRYANT

BRYANT CHUCKING GRINDER CO.

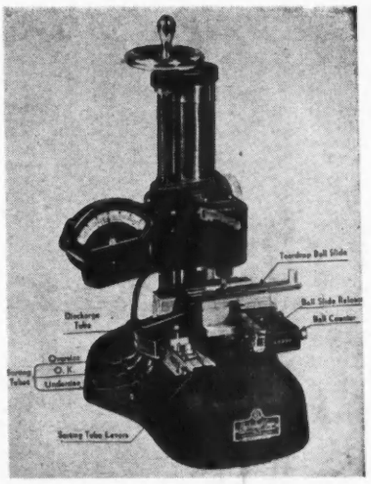
SPRINGFIELD, VERMONT, U. S. A.

The two soft V-jaws are said to grip firmly with low clamping pressure. The top jaw has a "rolling" action that automatically adjusts it to the work. It is reversible for small diameters. A wing nut, at the front, adjusts the tool to the size of the piece while a partial turn of a larger hand-wheel at the back regulates the pressure and quickly clamps or releases. Only one setting is required for all pieces of similar diameter.

Sorting Gage for Small Lots of Precision Balls

The P&W Model BE-748 Electrolimit ball sorting gage announced by Pratt & Whitney, Division Niles-Bement-Pond Company, West Hartford, Conn., is said to provide a fast and accurate method of quality inspection, by mechanical operation, of small lots of precision balls. With the addition of the cup type hopper and tube, which can be readily attached to the instrument, the operator's time can be greatly speeded.

The tear drop in the ball slide allows positive positioning of the ball between the T-C button on the anvil and the diamond gaging point, when the ball slide is in the gaging position. Deflection of the ball slide release lever allows the slide to be moved from the gaging position to the unloading position while

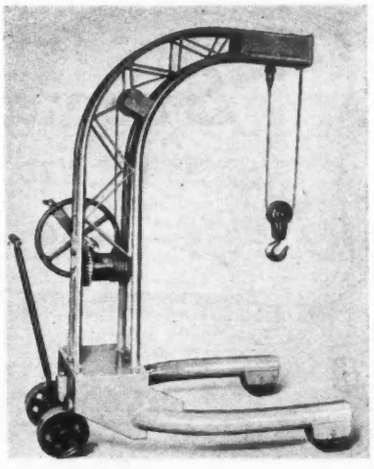


P&W model BE-748 ball sorting gage

at the same time tripping the ball counter. The indicating meter can be graduated to permit ball inspection to "tenths," "half tenths" or "hundredths."

Lightweight Portable Crane

A line of "Canton" portable cranes for handling loads where overhead lifting equipment is not available is offered by the Hill Acme Co. of Cleveland, Ohio. These new Canton cranes, made of welded steel, are said to weigh less than



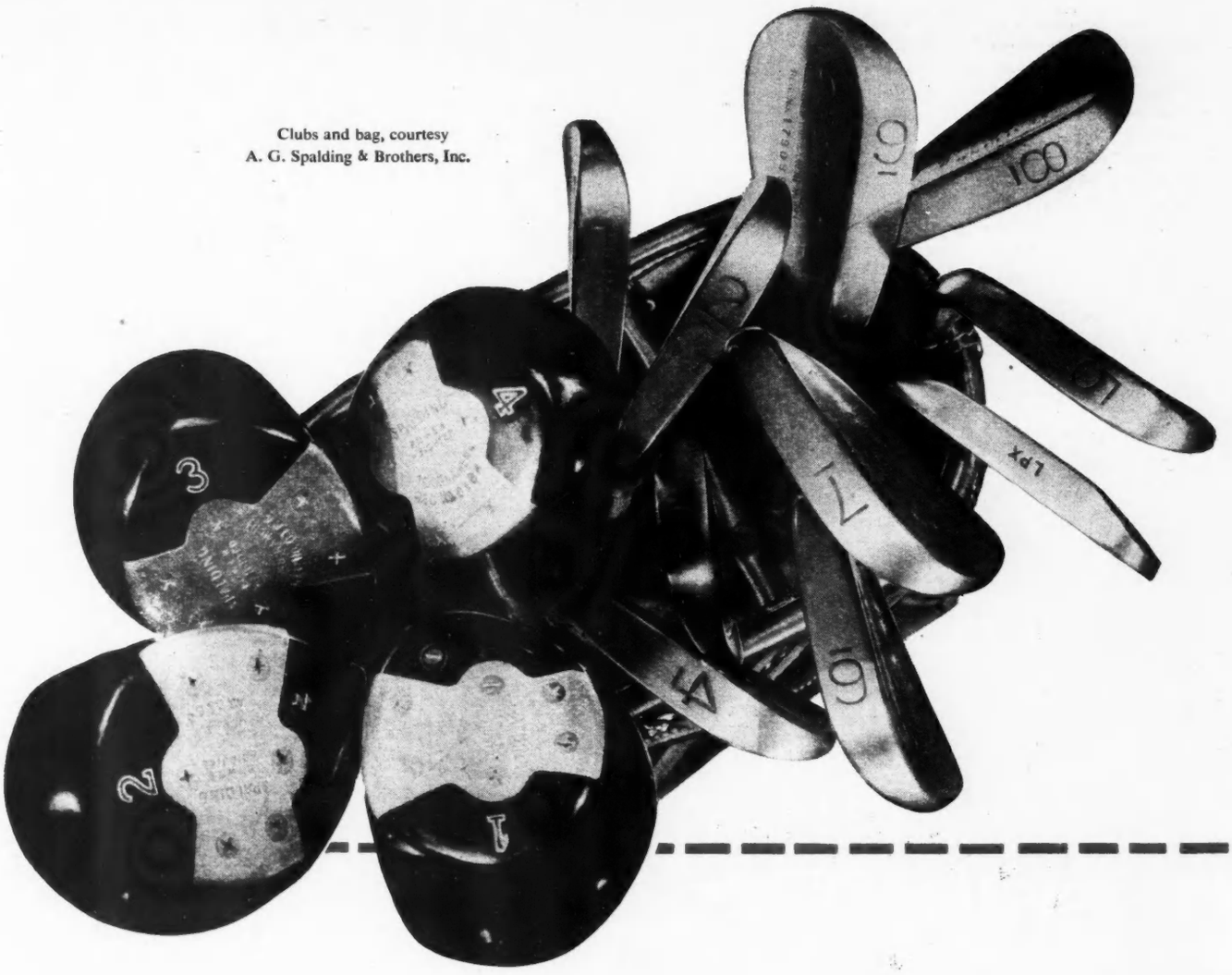
Canton portable crane

half as much as previous models. Two-speed operation is provided by means of a single or double cable for light or heavy loads. Adjustable extension handle gives additional leverage for extra heavy loads. A self-locking worm mechanism holds the load with safety at any point. Now available in all models of one to three-ton capacity.

Unit Absorbs Vibration In Any Direction

Vibrashock units, manufactured by Robinson Aviation, Inc., Teterboro,

(*Turn to page 74, please*)



Clubs and bag, courtesy
A. G. Spalding & Brothers, Inc.

DRIVER, BRASSIE, SPOON . . . or perhaps even a "5" iron, you choose your club according to the shot you wish to make.

Today it's much the same with aluminum: You choose the alloy, temper and form best suited to each specific job.

For example, to manufacturers of certain products, high unit-strength is a vital factor. To others, lightness may be even more important. Still others may require superior adaptability to forming or corrosion-resistance; or a combination of qualities.

Use of the *right* aluminum alloy means a better, more serviceable product at lower cost. Reynolds will help you specify it.

Whatever your interest, Reynolds technicians are ready to cooperate with your engineers. Offices in principal cities. Phone nearest office or write Reynolds Metals Co., Aluminum Div., 2513 South Third Street, Louisville 1, Kentucky.

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REYNOLDS METALS

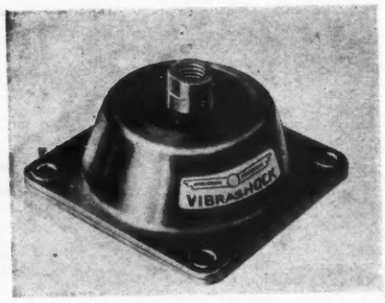
REYNOLDS ALUMINUM

The Great New Source of

INGOT • SHEET • SHAPES • WIRE • ROD • BAR • TUBING • PARTS • FORGINGS • CASTINGS • FOIL • POWDER

N. J., are available in three standard sizes and a wide range of load capacities to provide anti-vibration mounting for radios, engines, body suspensions and other installations.

In the Vibrashock unit, a departure has been made in the carrying of the principal load by a stainless steel spring of special design with three-way freedom of movement and built-in, three-way limiting snubbers furnishing a resilient stop to limit heavy shock loads. By elimination of rubber or synthetic for load carrying, the new mount avoids permanent set and vulnerability to cold, heat and humidity. .



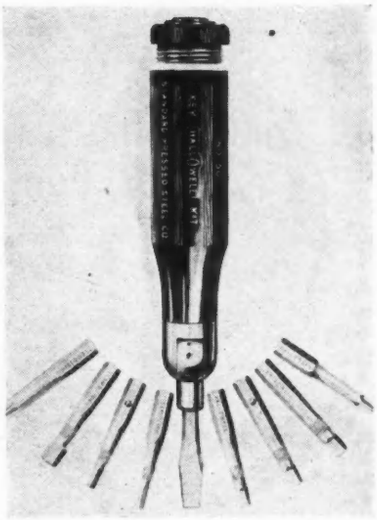
Vibrashock unit

New Key Kit

The "Unbrako" key kit was designed by the Standard Pressed Steel Co., Jenkintown, Pa., for driving slotted and Phillips head screws, and to improve the use of keys for driving socket set and cap screws.

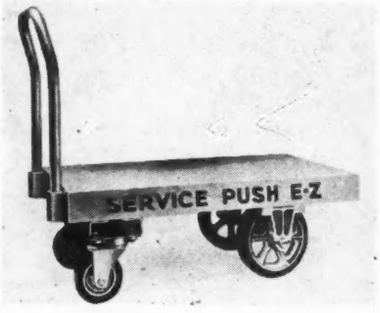
An indestructible, black plastic handle holds nine interchangeable bits. The swivel chuck, into which the desired bit is inserted, locks in five different positions; straight for direct drive, 45 deg and 90 deg for better leverage and to assist in reaching difficult locations.

The kit is made in two sizes; No. 25 containing seven hex, one Phillips and one slotted screw bit, and No. 50 containing six hex, two Phillips and one slotted screw bit.



Unbrako key kit

Push E-Z Truck



This all-magnesium truck built by Service Caster & Truck Division of Domestic Industries, Inc., Albion, Mich., in cooperation with the foundry division of Hills-McCanna Co., Chicago, weighs 103 lb less than the same truck made of steel. It is a Service Push-E-Z model with a capacity of 600 lb

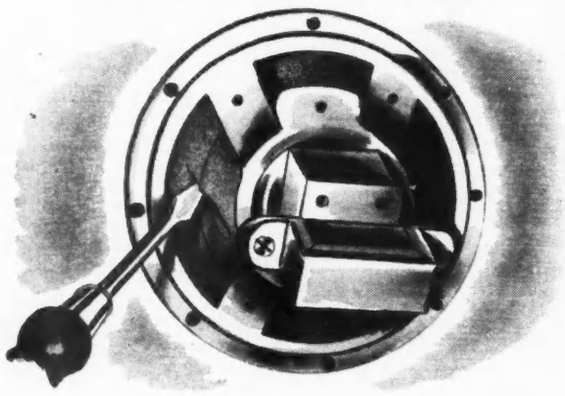
INDEPENDENT INVESTIGATOR'S STUDY SHOWS

How Phillips Screws Saved Emerson Radio $40 Daily Spoilage

THIS INVESTIGATOR from James O. Peck Co., industrial research authorities, is visiting a number of representative plants to get authentic FACTS on assembly savings for you.

GET HIS UNBIASED REPORTS READ THE COMPLETE FACTS!

100 Driver Skids a day eliminated ... at 40¢ a skid!

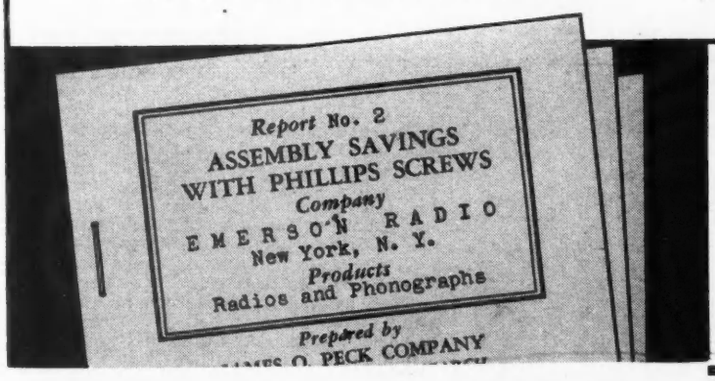


EMERSON RADIO & PHONOGRAPH CORP. use Phillips Screws for one good reason... *they cut costs!* Good example is the daily saving of $40 formerly used up reclaiming loud speaker cones ruined by driver skids from slotted screws.

That's only one way Phillips Screws save. They can be driven faster – allow use of power in place of hand drivers. They drive tighter – fewer and smaller screws can often be used. Burrs and broken screw heads are eliminated, and the ornamental design improves product appearance.

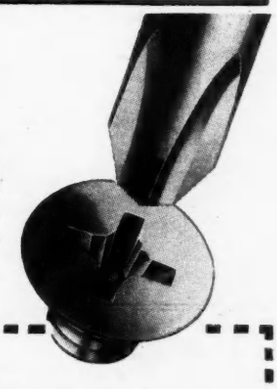
NOW, THESE UNBIASED REPORTS show how these advantages result in savings that add up *big* in yearly assembly records – savings you can't afford to miss with today's squeeze on profits.

THE ASSEMBLY STUDIES COVER ALL TYPES OF PRODUCTS – metal, plastics, wood. The report on Emerson – others now ready – and more to come – make up a practical manual of modern assembly methods, never-before-printed information, inside facts you'd pay good money to get, – and it's yours, now, FREE!



WHATEVER YOU MAKE, THERE ARE SAVINGS IDEAS HERE FOR YOU!

Find out how industry's best assembly experts cut costs! Get these reports, as they are issued. Don't wait... mail the coupon TODAY!



PHILLIPS *Recessed Head* SCREWS

Wood Screws • Machine Screws • Self-tapping Screws • Stove Bolts

27 SOURCES

American Screw Co.
Atlantic Screw Works
Atlas Bolt & Screw Co.
Central Screw Co.
Chandler Products Corp.
Continental Screw Co.
Corbin Screw Corp.
Elco Tool & Screw Corp.
General Screw Mfg. Co.
The H. M. Harper Co.
International Screw Co.
Lamson & Sessions Co.
Manufacturers Screw Products
Milford Rivet and Machine Co.
National Lock Co.
National Screw & Mfg.Co.
New England Screw Co.
Parker-Kalon Corp.
Pawtucket Screw Co.
Pheoll Manufacturing Co.
Reading Screw Co.
Russell Burdsall & Ward Bolt & Nut Co.
Scovill Manufacturing Co.
Shakeproof Inc.
The Southington Hardware Mfg. Co.
The Steel Company of Canada, Ltd.
Wolverine Bolt Co.

PHILLIPS SCREW MFRS.,
c/o Horton-Noyes
2300 Industrial Trust Bldg., Providence, R. I.

Please send me the reports on Assembly Savings with Phillips Screws

Name .....

Company .....

Address .....

.....

ACF-Brill and Hall-Scott Acquired by Convair

Consolidated Vultee Aircraft Corp. has purchased controlling interest in ACF-Brill Motors Co., and its wholly-owned subsidiary, Hall-Scott Motor Car Co. (California), manufacturers of motor buses, trolley coaches and specialized engines, from American Car and Foundry Co. in a cash transaction involving approximately $7,500,000, according to an announcement by Irving B. Babcock, board chairman of Consolidated Vultee.

The purchase marks the first entrance by a major aircraft producer into the field of automotive surface transportation. Under terms of the purchase Consolidated Vultee will acquire from American Car and Foundry Co. 445,139 of the 962,378 common shares issued and outstanding, and 160,464 warrants against 280,044 outstanding. Each warrant carries the right to purchase one common share at $12.50 until Jan. 1, 1950, and $15 a share until Jan. 1, 1955.

Mr. Babcock, who is expected to become board chairman of Brill, has been engaged in motor truck and bus production for more than 25 years. Until January, 1945, he was president of Yellow Truck and Coach Manufacturing Co., and a vice-president of General Motors Corp. Ronald R. Monroe, president of Brill, will continue in that capacity.

Present production by Brill is concentrated on two models of de-luxe buses, one for city and the other for inter-city operation. Both are powered by Hall-Scott underfloor engines. The backlog of unfilled orders is at present in excess of $50 million.

Having divested itself of substantially all interest in Brill, the American Car and Foundry Co. will not manufacture buses or trolley coaches for city operation, or buses for inter-city operation.

The Hall-Scott Motor Car Co., located at Berkeley, Cal., manufactures bus, marine and industrial engines.

BOOKS ...

RUBBER IN ENGINEERING by *the Service Rubber Investigations* on behalf of *the Controller of Chemical Research of the Ministry of Supply, Ministry of Aircraft Production and the Admiralty.* Inquiries should be addressed to Ministry of Supply, Advisory Service on Plastics and Rubber (C.R.D. 4b), Berkeley Court, Glentworth Street, London, N. W. 1.

This book provides information on a subject which, even by those who have long been engaged in its practical application, has been regarded as too unwieldly or indefinite to set out in print. The main purpose is to furnish engineers with a general survey of the information available on the fundamental properties of rubber. Accordingly, a considerable portion of the text has been devoted to the theoretical aspects of the subject, although the chapters dealing with these aspects have been so grouped that those readers who are more interested in the practical applications of the work can, if they wish, omit them.

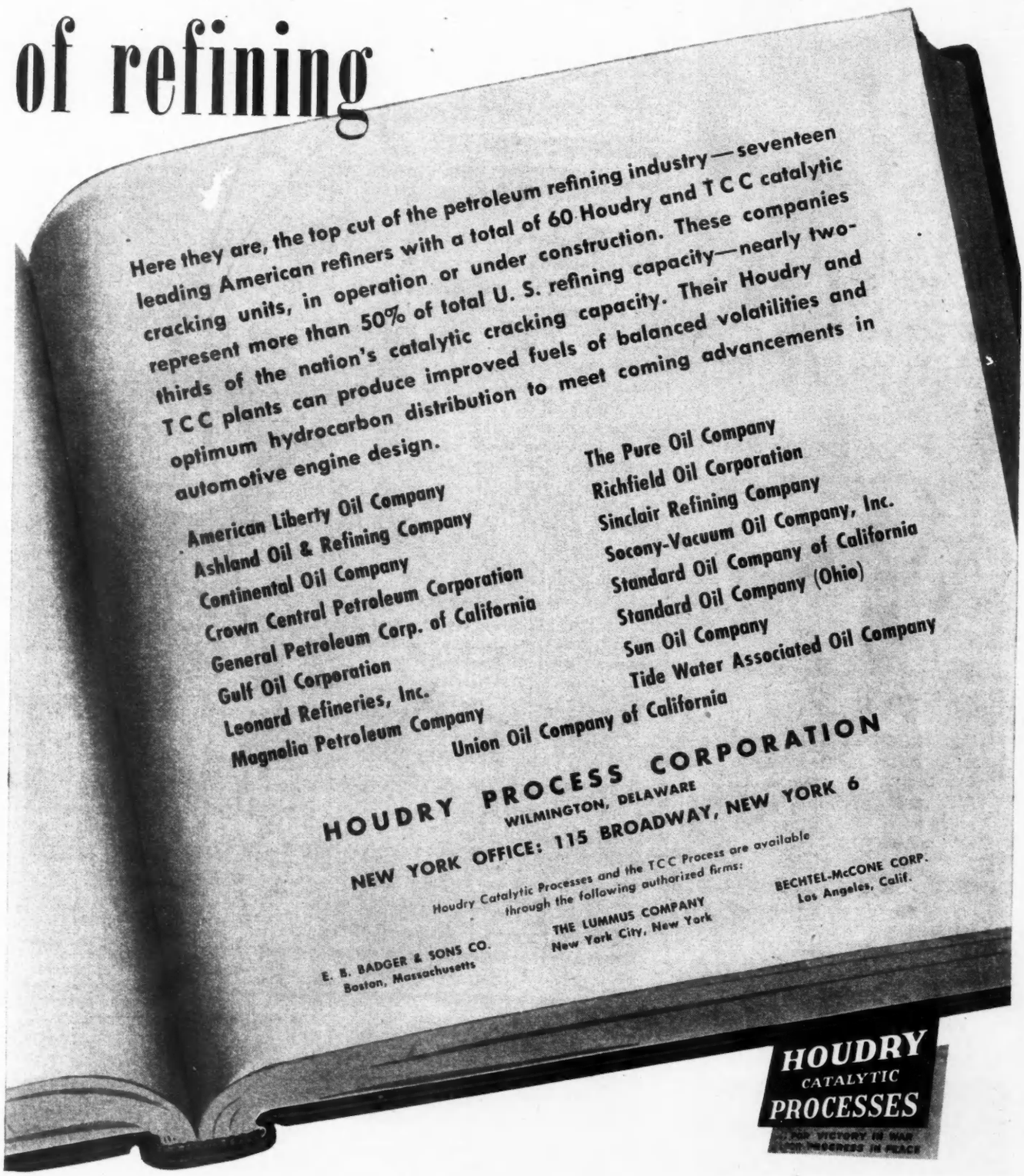
The book is not intended as a practical workshop guide to the design of particular rubber components, but rather as an exposition of underlying principles. The subject has been treated generally on the basis of a number of years' experience in the types of problem posed by those interested in both the manufacture and application of rubber articles.

AERIAL NAVIGATION by *H. E. Benham,* illustrated by *Benson Farish,* published by *John Wiley & Sons, Inc., New York.*

Navigation is a practical science. No amount of theoretical knowledge can produce an expert navigator unless this knowledge is accompanied by experience in the actual performance of navigation. However, a background of fundamentals is necessary. Therefore, the underlying theory has been presented to provide stu-

(*Turn to page 78, please*)

The list of Houdry licensees is the Blue Book of refining



dents of aerial navigation with practical instruction in today's techniques.

The objective has been to dispel the prevailing idea that navigation, particularly celestial navigation, is a mysterious and difficult science, and at the same time to avoid the substitution of rules of thumb and jingles for explanations. The text has been supplemented by diagrams to clarify explanation, and each chapter contains problems and answers to aid the student. Aerial navigation, pilotage, dead reckoning, radio navigation and celestial navigation are all integral parts of the picture of navigation, and all are fully discussed.

LESSONS IN ARC WELDING, *Second Printing, second edition*, published by *the Lincoln Electric Co., Cleveland, Ohio.* 176 pages with semi-flexible simulated leather cover. Price, postpaid, 50 cents in the United States, 75 cents elsewhere.

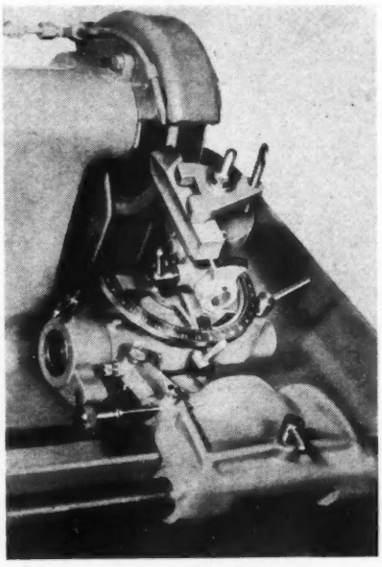
"Lessons in Arc Welding,' is a revised and up-to-date new printing of the second edition to assist both new and experienced welders as well as all persons interested or concerned with the subject, with complete and thorough instructions in all phases of arc welding.

(*Turn to page* 82, *please*)

Tool Grinder with Built-In Reciprocating Unit

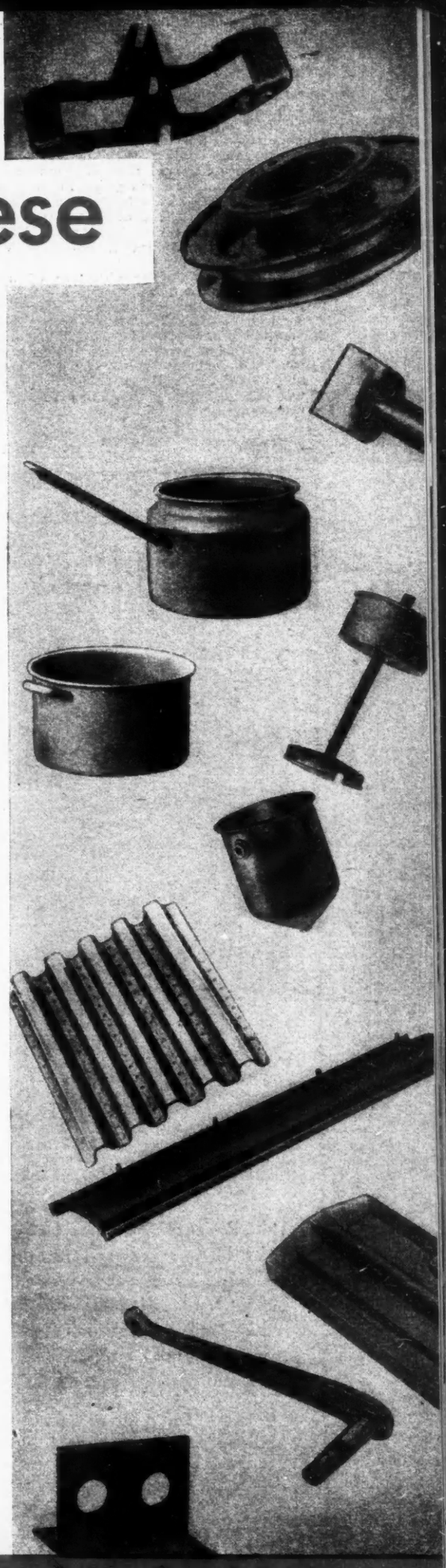
E. F. Hager and Son, Queens Village, N.Y., are making a carbide tool grinder with a built-in reciprocating unit that pivots on a definite fixed center and cannot float. The Hager carbide tool grinder grinds tools up to and including 1½ in. square. Carbide tools for lathes, automatic screw machines, milling cutters, offset tools, spiral reamers, counterbores and any other carbide-tipped tool within the range of the machine can be ground on the new grinder. Attachments are available for these and other types of carbide-tipped tools.

Mechanically maintaining the tool in constant motion is said to avoid localized overheating of the tool, prevent the carbide tip from splitting and save wear on diamond wheels.



Reciprocating action toolholder of the Hager carbide tool grinder

Never List ALL ion Possible On These Press-Type Welders



It is no exaggeration to say that the versatility of Federal Press-Type automatic Resistance Welders can never be fully described.

Reason is that *new* corner-cutting, cost-saving applications are being developed every day in the year. What it boils down to is that if you have any metal fabrication in production quantities involving the permanent fastening of metal, it is important from the standpoint of quality, quantity and cost, that you apply to its production design all of the saving and speeding this type of welding can afford. Whether it be joining of delicate parts, such as in the radio tube illustrated at upper left, or heavy parts involving half-inch steel, like the bell-crank at lower right, or one of a million things in between, Federal Engineers can show you quickly and clearly how the Federal method fits your production.

Shown at left are the smallest (PH-1) and the largest (PH-4) standard models of the Federal Hydraulic Press Type Welders. PH-1 machines rate from 30 KVA to 75 KVA . . . PH-4's are standard up to 600 KVA. There are many sizes in between, many types to choose from . . . Air Operated, Motor Operated or combinations of Air and Toggle mechanism. They are adaptable to projection, spot or "percussion" welding or resistance brazing.

Write today for a Federal Press Type Welder Bulletin or arrange for a consultation on your own designs with a Federal engineer.

IN RESISTANCE WELDING THE NAME OF AUTHORITY IS

Federal

AND WELDER COMPANY

220 DANA STREET
WARREN, OHIO

The book includes 61 lessons in arc welding and has over 200 illustrations to supplement the text. From the very first paragraphs dealing with "Instructions to the Operator," to the 571 examination questions and answers given in the closing pages, the book sets forth in plain simple language, the practical instruction based on the experiences of Mr. Arthur Madson, head instructor in the Lincoln Arc Welding School.

Published with the objective of aiding those interested in welding to use the process successfully and economically, "Lessons in Arc Welding" explains the fundamentals of this method of joining metals by the fusion principle and incorporates a wealth of new information such as how to apply the latest types of electrodes and welding techniques developed during the war years.

ASTM STANDARDS ON PETROLEUM PRODUCTS AND LUBRICANTS prepared *by ASTM Committee D-2* and published by *the American Society for Testing Materials.*

This latest compilation of ASTM Standards on Petroleum Products and Lubricants brings together in convenient form over 80 specifications, tests, and definitions that have been standardized through the work of Committee D-2 on Petroleum Products and Lubricants.

In addition to the current report of the committee, there are several appendices covering the following: results of tests and method for estimating maximum pour points of lubricating oils containing pour point depressants, and two proposed methods covering a test for maximum pour point and total olefinic and aromatic hydrocarbons in gasoline.

The specifications cover cut-back asphalts, rapid and medium curing type; emulsified asphalts, five types; petroleum spirits; Stoddard solvent; thermometers; fuel oils; gasoline, etc.

The large number of test methods provide authoritative procedures for determining properties of a wide range of petroleum products, for example, acid heat of gasoline, aniline point, ash content, autogenous ignition temperatures, aromatics, olefins, benzene and isopentane insolubles, crankcase oils, knock characteristics, of fuels, specific gravity, color, distillation, melting point, viscosity-temperature charts (Saybolt and kinematic), etc.

Copies of this 530-page compilation can be obtained from ASTM Headquarters, 260 S. Broad St., Philadelphia 2, Pa., at $2.75 each with special prices on orders in quantity.

PRODUCTION ILLUSTRATION, by *John Treacy,* published by *John Wiley & Sons, Inc., New York.* Price $4.00.

The widespread adoption of perspective illustration as a medium of engineering presentation has been sudden, and its application varied. The techniques which have been confirmed by actual industrial usage have been presented in this book for the study and guidance of technical illustrators, production plants, specialized training classes, and schools and colleges. It is an exposition of production illustration from all pertinent aspects, and the illustrations selected for examples are actual production drawings, incorporating the most practical and widely accepted standards. Though the material has been drawn mainly from the aircraft industry, the methods are applicable to almost any product or type of manufacture.

The subject falls logically into two main parts. First is the actual preparation of production illustrations; the drafting and shading techniques, short-cuts, perspective methods, reproduction aids, and other "tricks of the trade." Second is the introduction and practical application of illustration to the problems of industrial production; the why, what, when, and where. Drafting practices and general engineering information found in available standard textbooks have been avoided, except when they bear special significance to the subject.

Lincoln-Mercury Assembly Plants Being Constructed

Construction of a new Lincoln-Mercury assembly plant at Los Angeles now is underway. T. W. Skinner, Lincoln-Mercury general manager reports that ground was broken Jan. 1, and the plant will be completed and in operation within a year.

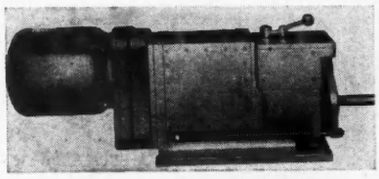
The building will be a one-story steel and reinforced concrete structure with approximately 426,000 sq ft of floor space. It is designed for production of 250 cars a day. In addition to the assembly and parts depot building, which will be 300 ft wide and 840 ft long, two other separate structures will be built—an executive office building, garage and showrooms, and a storage building.

Another Lincoln-Mercury plant will be built at Metuchen, N. J. When completed, the two plants will be the first to build Lincolns outside the Detroit area.

New Production Equipment

(*Continued from page* 46)

The O. D. is turned to size with one or two tools mounted on the front slide. The piece is automatically ejected at the end of the cut, when both spindles are backed off, thereby releasing the finish turned piece which remains in the loader until indexed into the unloading chute.



Hesco unit model 100

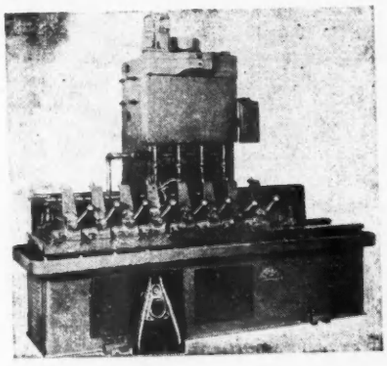
A NEW unit for drilling, reaming, counterboring and spotfacing, called the Hesco unit Model 100, is a development of the Hole Engineering Service, Detroit, Mich.

The unit is of completely mechanical construction and provides positive feed rates. Compact in design with long feed stroke, the Hesco permits close grouping in multiple installations for unison or sequence operations. It can be mounted in any angle or plane.

The unit is available in either belt or motor drive types. In the former type the motor is mounted above and in the latter the motor is mounted in line, forming a streamlined arrangement.

The lead screw feed provides control of chip per flute, with cold or warm unit. When different feeds are required, the change can be made to other lead screws and mating nuts. Quick advance and feed depth are adjustable from front of unit. Hand control is provided for setting of tools. Remote electrical control is furnished through inbuilt limit switches.

Special Tapping Machine



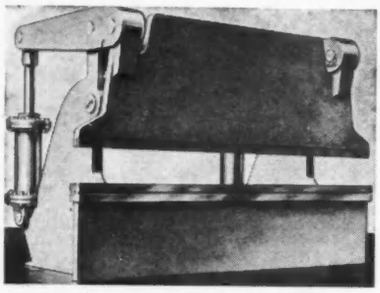
This four-spindle tapping machine for tapping automotive front wheel support brackets was designed and built by Snyder Tool & Engineering Co., Detroit, Mich. The machine has a welded steel column containing the tapping spindle drive motor, leadscrew mechanism and the necessary depth control limit switches. The fixture table is equipped with eight fixtures, thereby making it possible to work on four parts while four finished parts are unloaded and the fixtures reloaded. The fixtures and the table move hydraulically from the loading to the working positions. The base of the machine contains the hydraulic equipment for moving the table and the fixtures back and forth. The lubricant for the taps is contained in the lower portion of the column

KNOWN as the Pacific Model 325, a new hydraulic press for bending, braking, shearing, multiple punching and similar operations has been brought out by Pacific Industrial Manufacturing Co. of Oakland, Cal.

The press has a working pressure of 325 tons and maximum pressure of 395 tons. It is equipped with electrical controls which are said to balance pressures on the two hydraulic pistons so accurately that the 12-ft ram will operate parallel with the bed, or maintain the desired pre-set "tilt" within ± .005 in. whether the work is done at either end or in the center of the ram.

Among the features of the new press

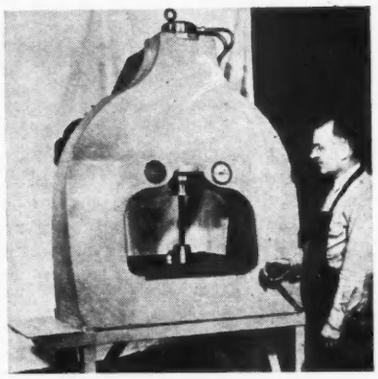
(*Turn to page* 86, *please*)



Pacific model 325 hydraulic press

are its ability to deliver maximum pressure at any point in the stroke and for the duration of the stroke, micrometer stroke adjustment, excellent work clearance overhead in front and in back of the ram, and a minimum of working parts.

NORTHERN TOOL AND MACHINE CO., Melrose Park, Ill., has placed on the market a 20-ton, motor-driven, self-contained, portable hydraulic press. The manufacturer states that the massive arch frame, fabricated from steel plates and heat treated to relieve stresses, eliminates all tendency to "walk" or distortion by dividing the ram force between both sides of the press.

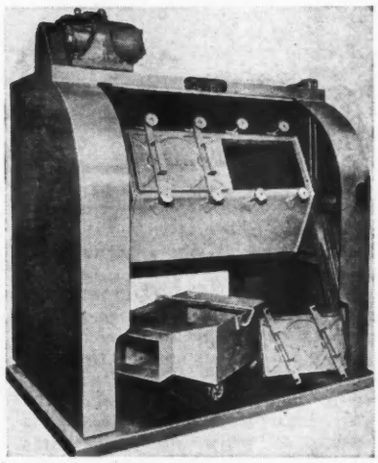


Northern portable hydraulic press

The press arch is 14 in. high by 24 in. wide. The alloy steel platen, 16 in. by 18 in. by 2 in., is ground on both sides, drilled and tapped to accommodate all set-ups to the capacity of the press. Power stroke speed is 90 ipm and is adjustable to any length from 0 to 12 in.

The ram is controlled by hand lever, and travel can be regulated fast or slow, stopped at any point in its stroke or to hold on work under pressure while motor idles or is turned off.

GLOBE STAMPING DIVISION of Hupp Motor Car Corp., Cleveland, Ohio, is producing the new Globe "Burr-Rite" de-burring machine in three models. The single compartment model has a content of 18.4 cu ft. In the double compartment model, each compartment has a capacity of 9 cu ft, and in the triple compartment model, each compartment has a 5.1 cu-ft capacity. The handling of parts has been simplified by the installation of a new hoist pan. Large lightweight doors make loading and unloading easier. To maintain continued production, the large compartments can be relined with maple liners without removing the shell.



Globe "Burr-Rite" de-burring machine

Parkerizing in Color for Iron and Steel

The Parker Rust Proof Co., Detroit, Mich., has introduced a chemical immersion process that imparts colors to Parkerized iron and steel surfaces, and at the same time materially increases the corrosion resistance of the coating.

Color Parkerizing, a complex phosphate coating which is integral with the surface of the metal, is completely insoluble in water, does not smudge, chip or peel, and is said to effectively retard the spread of corrosion from any abraded areas. The coating does not cause any appreciable build-up over ordinary Parkerizing, and it may be applied to threaded articles or to assembly parts on which Parkerizing is commonly used.

Color Parkerizing is applied by immersion and uses no electric current. Complicated shapes and parts with threaded members and holes are coated equally as well as flat surfaces. The coating results from chemical reaction. It is uniform, and there is said to be no possibility of drips or tears. Complete coverage is claimed to be assured as the chemical solution easily reaches all cavities and depressions.

The formation of the color is extremely simple. After Parkerizing and rinsing, the articles are carried directly into the aqueous color bath, without drying. The immersion period in the color bath is generally two to six minutes, then the articles are rinsed and dried, and oiled if desired.

The color treatment requires such a short immersion that when it is made a part of the regular Parkerizing process practically no additional labor costs are involved. Articles which are Parkerized collectively may be colored in the same container in full drum loads. Articles processed by immersion can be colored on the same racks. The chromic acid dip is omitted from the Parkerizing process, thus offsetting some of the additional equipment required for producing the color.

The equipment required for the process is simple. A wooden or steel tank lined with lead is adequate. Rinse tanks may be constructed of wood or steel. The same steel drums or baskets used for Parkerizing may be carried through the color treatment. The solution is operated at the boiling point and therefore temperature control is not required.

Simple control methods are used to determine the replenishing of coloring chemical required, and in general, replenishing the bath every few hours is sufficient.

At present the colors available are gray, blue, purple and green. Olive drab can also be supplied. With the exception of the gray there is some fading on exposure to sunlight, and these colors are not recommended for outdoor use where color fastness is required. However, this factor in no way lessens the excellent corrosion resistance afforded by the coating.

Color Parkerizing not only furnishes the manufacturer increased corrosion resistance, but at the same time is of value in the identification of parts, as in the case of springs of similar size but of different tension and composition. There are screws having slightly different threadings, or fractional differences in length and head sizes, and numerous other products of substantially the same shape and appearance, but actually made of different alloys and intended to serve in different places in the assembly. Quick identification by color is especially valuable in the case of valves, sprinkler systems, and in all assemblies that employ right and left hand threads.

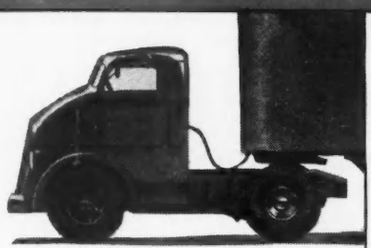
"Dreadnaught" ELECTRICAL CONNECTION COUPLING-CABLE KIT for ALL Tractor-Trailer Combinations

Rugged, Permanent, Weather-Proof Installation Assures Trouble-Free Service for Running Lights, Stop Signals, Turn Signals, Parking Lights — All Electrical Contacts FOR LIFE OF THE VEHICLES.

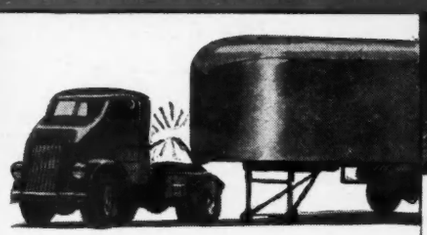
THIS COMPLETE KIT EASILY INSTALLED!

The WARNER "Dreadnaught" Kit includes 2 ruggedly constructed, weather-proof Coupling Sockets. (1 each for cab and trailer). Heavy-Duty Coupling-Cable with wires and rugged connector units for all electrical requirements molded in extra heavy, flexible rubber "hose," as easy to plug in or out as a radio — Cable Supporting Spring and Clamp — complete with Mounting Bolts, Nuts and Washers for quick, easy installation.

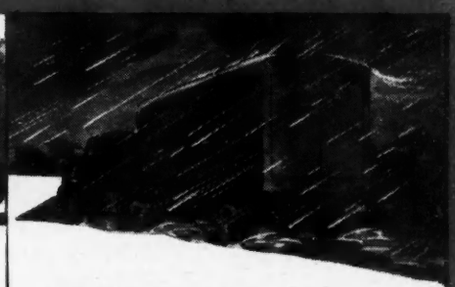
SOLVES THESE PROBLEMS



Flimsy, ordinary connections fray or break under severe road and weather conditions.

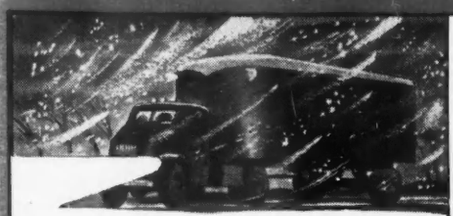


No snapping off by a "pull-away".

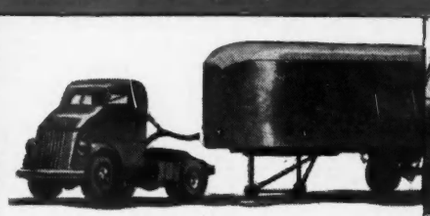


Trailer "blackouts" bring fines, delays, and accidents!

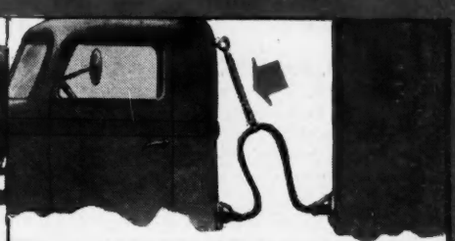
PROVIDES THESE ADVANTAGES



— Ruggedly constructed, weather-proof WARNER "Dreadnaughts" stand up under severest road and weather conditions.



If driver fails to disconnect on drive-away, rugged cable pulls connector out of trailer socket — cover springs shut to prevent corrosion.



Heavy Cable Support Spring prevents cable from dropping in mud, water or sand.

A Product of **WARNER ELECTRIC BRAKE MFG. CO., Beloit, Wisconsin**

Costs of Union Functions

(*Continued from page* 17)

by representatives who conducted collective bargaining for the companies and this cost while not measureable, certainly is considerable. In this connection, it should be noted that since the advent of collective bargaining the time and effort spent by top management on labor relations have increased and still are increasing. Officials from the president down must spend more and more time in conferences which too often degenerate into a fruitless wrangle and wasted time. The salary cost of the talent engaged can be determined, and is terrific, but the loss of productive effort by top management who should have been spending their time on their normal duties is incalculable.

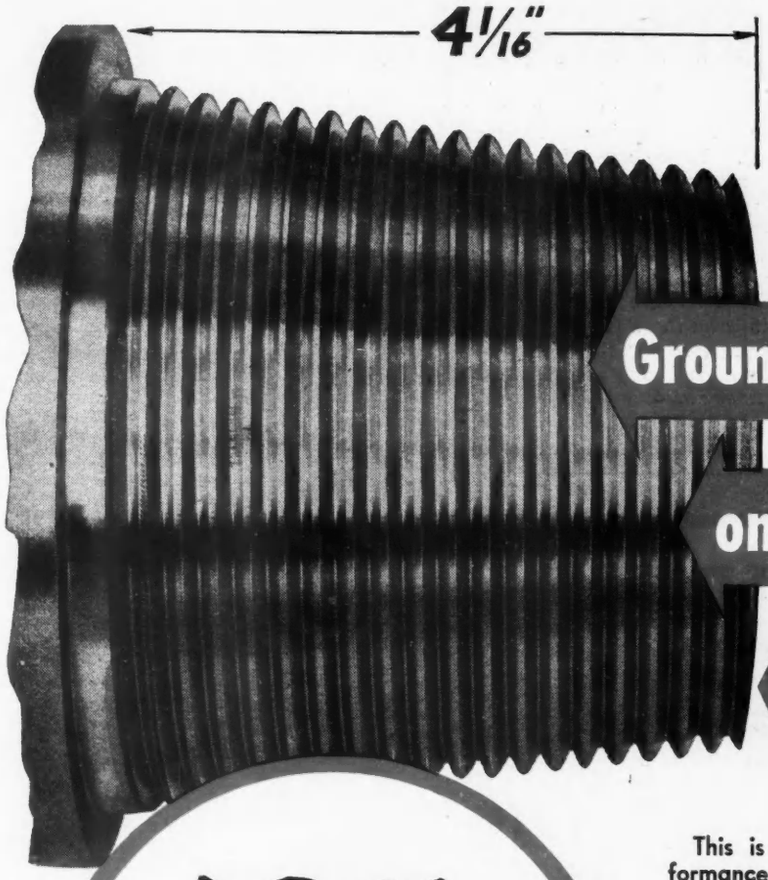
Collective bargaining is an expensive business. The time and money spent in preparation for meetings, the long distance telephoning, the legal costs involved for advice and preparation of papers, the travel time and expense when meetings are held in Washington and other cities, and many other items are direct business costs which result from present-day labor union organization. Practically every company today has an industrial relations department which is growing steadily. Cost of public relations and advertising to bring disputed issues before the public also has jumped astronomically.

The so-called "fringe" issues also contribute heavily to labor costs under unionism. Such benefits as sick leave, call-in pay, vacation with pay, travel time, shift differentials, pay for holidays not worked, double time for certain Saturdays, Sundays, and holidays worked, and similar gains are direct result of union pressure and regardless of their merit, which is not in question here, pile cost on cost.

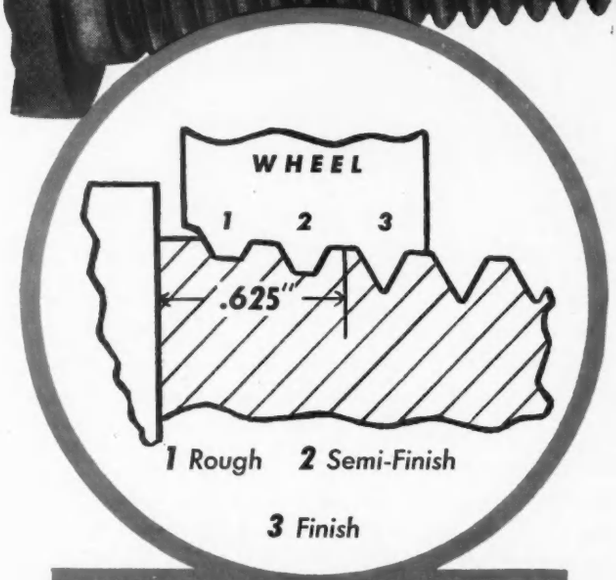
Seniority as promoted by unions today is another factor which can and often does increase costs. In pre-union days in the automobile industry, advancement came through the ranks on the basis of merit, and there was an incentive for greater productive efficiency. Although this still governs to some extent, union efforts to resist promotions on anything but length of service are having their effect, with a consequent lowering of initiative and efficiency. Maintenance of membership also has proved to be of doubtful benefit. One company last year was forced to discharge more than 2000 old-time class workmen because they became fed up with the union and preferred to be discharged rather than to stay under intolerable conditions. The company lost some of its most valuable employes that way.

Jurisdictional disputes and political feuds within the union itself often are

(*Turn to page* 94, *please*)



Ground from the solid with one pass of the wheel, in less than 4 min.



This is a typical example of multi-rib wheel performance on tough, heat-treated steel forgings with Jones & Lamson Automatic Thread Grinders.

The 5-pitch, special form API thread, with a taper of 3 inches per foot, and a mean outside diameter of 4.117", is ground in less than 4 minutes cutting time with a three-rib wheel, one rib roughing, one semi-finishing and the third finishing. More than one pound of metal is removed.

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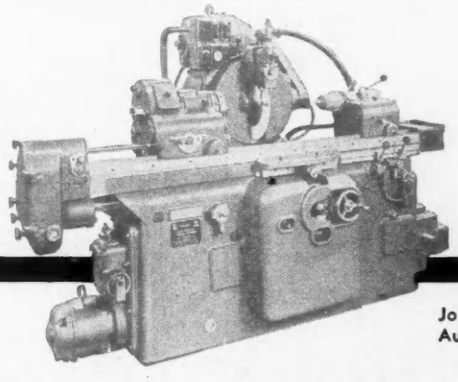
Why not phone today for one of our engineers to tell you more about production threading with Jones & Lamson Automatic Thread Grinders.

For shorter threads, other multi-rib wheel forms can be used—the full rib type that requires only one complete revolution of the work, and the alternate rib type that requires two complete revolutions. Our engineers can determine the most advantageous method for your needs.



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costly to management as an innocent bystander. The famous "Soda Pop" war between rival unions over which would represent drivers of trucks delivering soft drinks to Chrysler Corp. plants is a good example. Another is the more recent shutdown at Dodge Truck Division when AFL pickets stopped delivery of materials into the plant in an attempt to require the company to force dealers to hire AFL driveaway members. In both cases, the company was not in dispute with its own workers, yet was subjected to a financial loss through suspension of operations. Labor observers in Detroit think that jurisdictional disputes are bound to increase.

In enumerating the added costs under union contracts, we are in no way advocating that unions should be abolished. There are of course, corrective measures needed to remedy some apparent evils. The consensus of the automotive industry is that unions can and will be made to work when they assume the responsibilities incumbent upon them. There are hopeful signs that this is on the way. The Ford local has expressed some willingness to agree to a form of company security by a system of fines for offending workers who engage in wildcat strikes or slowdowns. Details have not been worked out, however.

The real question of costs rests on what functions now performed by management for the union should be borne by the union and how functions retained by management can be reduced in scope. It is hard to justify, for example, payment by the company to union members for time spent conducting union business. General Motors has proposed that in a new contract provision be made for sharing this cost equally between the union and the corporation. Ford has proposed that if the company is to continue the checkoff system, the union must agree to a company security proposal. Chrysler has proposed that the union assume the entire cost of conducting union business. From these three cases, it is apparent that the automobile companies are prepared to fight for something in return for the benefits granted to the unions.

The general consensus is that some of these expensive functions now borne by the companies may in time be reduced in extent and perhaps some of them taken over by the unions. However, the great bulk of the expenses enumerated in this article probably are here to stay and must be reckoned with as a continuing element of production cost.

Surplus Airplane Sales Reach 16,837 by End of 1945

Of the 59,376 airplanes which have been declared surplus to War Assets Corp., 16,837 had been sold for a total of $37,637,204 by the end of 1945.

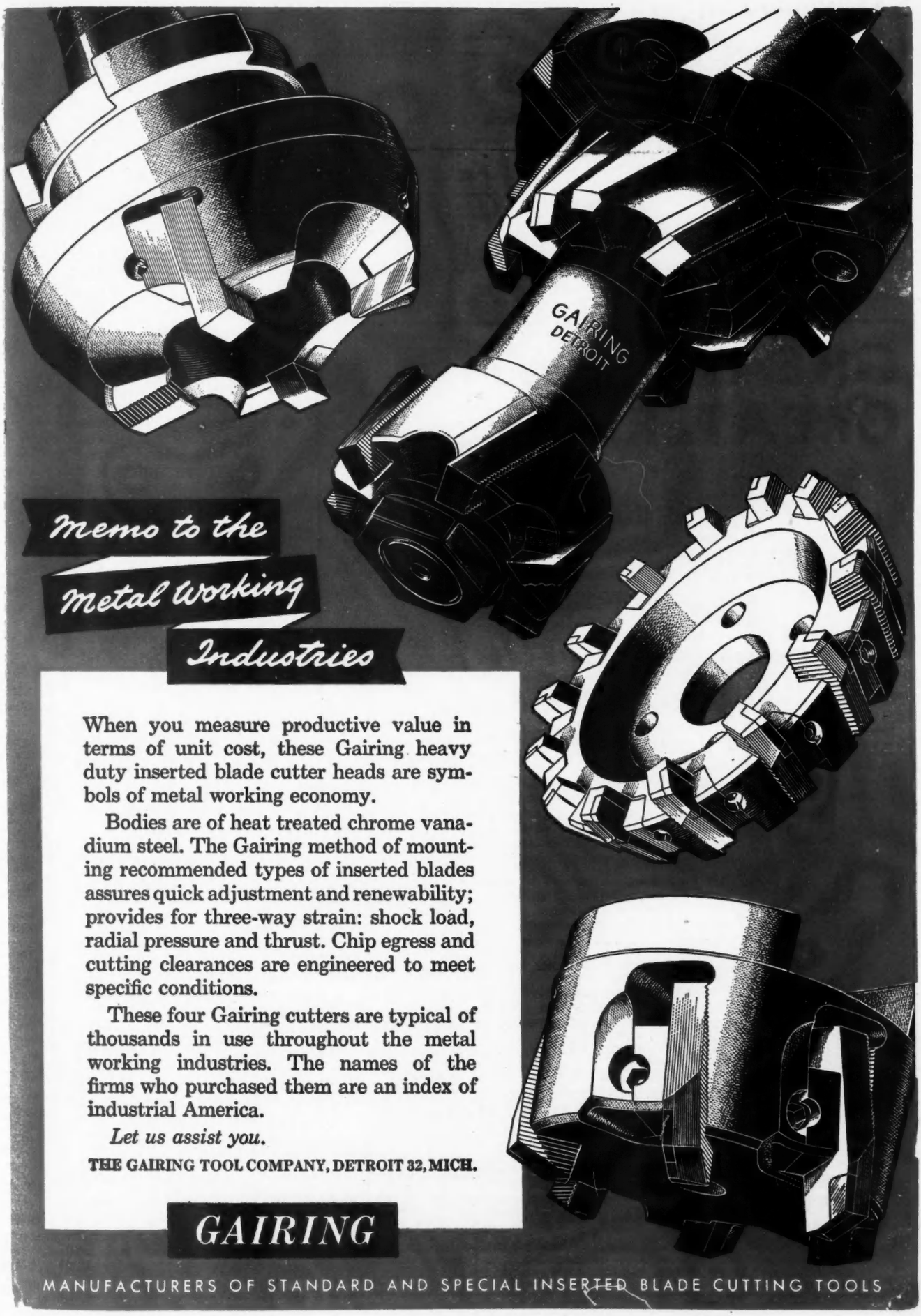
The number of surplus planes sold represents 68 per cent of the total number in civil operation prior to the war.

Only 23,764 of the surplus planes are of types normally considered salable, and 16,503 of these have been sold for $36,196,052. In addition, 334 of the 35,576 tactical and other types of planes which are not considered readily salable were sold for a return of $1,441,152.

Largest number of planes sold were in the primary trainer and liaison types. Of 18,549 planes of these types declared surplus 15,342 were sold for $17,102,500. Two hundred thirty utility cargo planes out of 432 declared surplus were sold for $1,432,693.

The above figures include 5,376 airplanes which were sold for the RFC by the Civil Aeronautics Administration for $8,200,119.

It was in the transport class that the largest amount of money was received. A total of 696 light transports out of 2,734 declared surplus brought $5,362,458; 301 medium transports of 1,193 surplus sold for $10,403,398; and 31 of 855 surplus heavy transports returned $1,895,000.



Memo to the Metal Working Industries

When you measure productive value in terms of unit cost, these Gairing heavy duty inserted blade cutter heads are symbols of metal working economy.

Bodies are of heat treated chrome vanadium steel. The Gairing method of mounting recommended types of inserted blades assures quick adjustment and renewability; provides for three-way strain: shock load, radial pressure and thrust. Chip egress and cutting clearances are engineered to meet specific conditions.

These four Gairing cutters are typical of thousands in use throughout the metal working industries. The names of the firms who purchased them are an index of industrial America.

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SAE Papers on Gas Turbines

(*Continued from page* 39)

lence. The air penetration distance will, of course, be less when the openings are of such shape and size to give high envelope surface for the area of the current, so that the viscuous drag is greater. Spiral whirls, when around the axis of the burner tube, tend to localize the flame in the center, with a denser cold air envelope on the outside.

Baffle construction is of particular interest because it is an elementary example of graduated turbulence. As indicated in "D," Fig. 10, the region in the center of the baffle plate is relatively quiescent, particularly at the lower air speeds, although there is quite a strong local current at the lee edges. If the spray jet and ignition are located at the center, the flame stability may be somewhat better than that of "A," if the latter is in a tubular burner. At large fuel feed rates, the volume of gas flowing out from the center will tend to balance the inflowing or reverse axial air currents, thus reducing the tendency to blow the flame away. This favorable condition will not be present in starting or idling at high air speed. The reverse air whirls are not particularly stable behind a plate, and may change irregularly. "E" shows how to maintain a one-way rotation, and "F," how to make more stable the double whirl type. These points may be recognized as taken from carburetor practice.

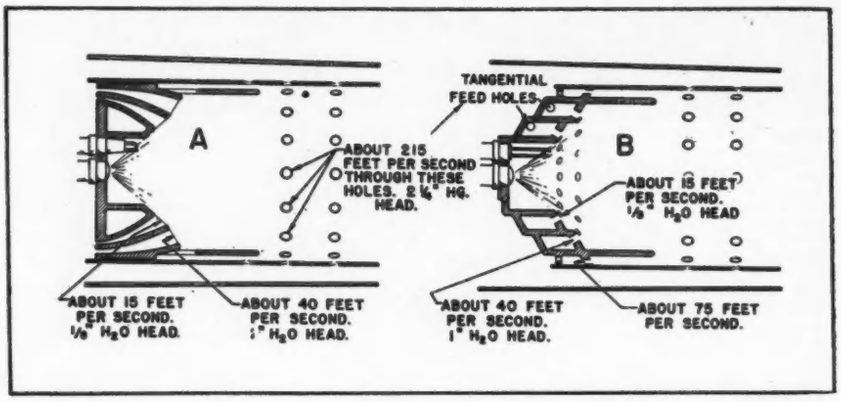

Fig. 11. Examples of graduated air velocity burners

A more completely controlled graduation of air velocity around the jet is shown, in two forms, in Fig. 11. In both forms, a central cup is used to give a central stable flame nucleus fed only by relatively gentle axial reverse currents. Surrounding this are several annular sheaths of air at successively increasing velocities. The inner one may be delivered at a pressure differential of 1/16 in. of water, corresponding to 15 fps, when there is 2 1/4 in. of Hg pressure difference or 300 fps across the burner tube. The next ring of orifices may deliver at ½ in. of water differential, giving 40 fps, while additional stages of increasing velocity discharge may be added as desired.

The velocity graduation in "A" is obtained by expanding conical passages (a larger round on the entrance will make a venturi tube out of the passage and defeat the purpose of the construction). In "B" the velocity graduation is obtained by using a small restriction in the outer wall of each annular chamber to reduce the flow and the pressure potential across the inner orifices. With both these forms, additional side holes

(*Turn to page* 98, *please*)

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must be arranged downstream in the burner tube to admit more air and break up the central tongue of flame.

Experience indicates that this expedient is very valuable in giving a stable flame over wide ranges of air velocity and fuel feed rate; that the burning conditions are much more favorable, so that complete combustion can be obtained in smaller volume of burner; and cleaner, less oily flame can be used without blow-out. Additional requirements are first, a means of heating the cup so that the spray may be allowed to impinge upon its walls, and second, the development of proper turbulent mixing beyond the region shown, plus an addition of cooling air. Obviously, if complete combustion is obtained in a region of only 15 to 1, air fuel ratio, the local temperature there will be very high and a very long expanse of chamber at this air/fuel ratio cannot be tolerated. As a matter of fact, the construction of Fig. 11 works best when air less than 15 times the fuel weight is admitted through the chambers shown, so that air from the side holes in the tube is required to complete the combustion.

Factors Affecting the Design of Jet Turbines

By WILLIAM R. HAWTHORNE,
British Ministry of Aircraft Production

IN JET engines the turbine is only required to drive the compressor plus a few engine auxiliaries and aircraft accessories geared to the rotor. Allowing for this and for windage losses, it is reasonable to assume that the turbine work is between two and three per cent more than the work done on the air by the compressor. It may also be assumed that the addition of the fuel mass to the working fluid in the combustion chambers is balanced by the removal of air from the compressor for cooling purposes, so that turbine and compressor handle the same mass flow. Allowing for the different specific heats of gas and air, it follows that the temperature drop, or the temperature equivalent of the work required from the turbine, is about 0.9 times the temperature rise in the compressor.

In single stage turbines for jet engines, the velocity of the gas leaving the turbine nozzles is supersonic. A throat, therefore, exists in the turbine nozzles and the mass flow is proportional to its cross-sectional area. The overall dimensions and weight of the turbine required for a given duty do not, however, depend directly on the throat area. The area and the mass flow may, in fact, be increased until the velocity of sound is reached at the outlet from the buckets or in the propelling nozzle. The mass flow will then reach the limiting value for the given inlet pressure and temperature. Because the size of the propelling nozzle may be easily altered, the maximum capacity of a turbine occurs when the flow leaving the buckets reaches the velocity of sound. The convenient parameter is the Mach number based on the axial velocity of the gas in the turbine exhaust annulus immediately downstream from the turbine buckets. It is assumed that the radial height of the exhaust annulus at the point considered, is equal to the radial height of the gas swept trailing edges of the turbine buckets. The velocity on which the Mach number is based is the mean value over the annulus area and is relative to the fixed walls of the exhaust duct. The choice of turbine exhaust Mach number and annulus area greatly affect the mass flow and thrust output of the engine.

In jet turbines with centrifugal compressors, the frontal area of the turbine is appreciably less than that of the compressor and combustion chamber assembly. The size of the turbine disk is, therefore, not a factor which determines the overall dimensions of the engine. Smaller disks, however, lead to lower weights and stresses. The stresses in a disk of given shape are roughly proportional to the square of the rim speed, since the secondary effect of the loading due to the buckets may be neglected in a preliminary analysis. The

(*Turn to page* 100, *please*)

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rim radius is defined as the inner radius of the turbine exhaust annulus.

A lower limit to the rim speed is set by the flow conditions through the root section of the buckets. Here, if a slight pressure drop, for reaction is to be maintained through the buckets and excessive swirl in the exhaust annulus is to be avoided, the temperature equivalent of the work done may not exceed a certain factor times the square of the rim speed. If the temperature drop is expressed in deg F and the rim speed in fps, this limiting proportionality factor is 4.5 x 10—4. It is advantageous from the point of view of efficiency to work well within the value of the factor quoted, in other words to use a high rim speed. Also the turbine bucket temperatures may be reduced by increasing the rim speed. This conflicts with the requirement of low rim speed to keep the disk stresses and weight low. In making the compromise, British designers have used values of the rim speed from about 850 to 1000 fps.

Mechanical Design Considerations Influencing Blading Performance in Aircraft Gas Turbine Power Plants

By NATHAN C. PRICE,
Director, Power Plant Engineering Div., Menasco Manufacturing Co.

SUBJECT to manufacturing limitations affecting strength of the basic alloy used, hollow blades or buckets, particularly those with tapered walls, are preferable to solid blades. Such blades afford an opportunity for better control of natural frequency without entailing excessively thick blade sections which, particularly in a compressor, might reduce efficiency. Compressor or turbine blading may be provided with an additional twist to offset errors in angle of incidence resulting from centrifugal load couples or creep. There is a potential advantage in leaning rotor blades slightly away from the normal, in order to balance gas forces with a lateral component derived from centrifugal force, thereby reducing stresses. A sheet metal compressor blade of constant wall thickness can withstand a tip speed of well over 1300 fps, which is in excess of axial flow compressor requirements. Compressor blades are preferably made of a hard, erosion resistant material to prevent loss of efficiency in service. Some otherwise desirably airfoil sections are unusually susceptible to performance reduction caused by surface roughness. A material which can be given a good permanent polish by buffing such as steel or age-hardening Monel should be used.

The turbine buckets may have a wall section tapered in the ratio of two to one, thus reducing stresses to a very low value, well within the limits required from creep and hot stress-rupture standpoints. These turbine buckets may be precision cast by the "lost wax" process from a high cobalt-nickel-chromium alloy. In a typical case the root stress of the bucket may be as low as 12,000 psi. The use of hollow blades reflects a real saving in power plant weight by reducing the eentrifugal force on drums or wheels and permits internal cooling by air or other fluids. The use of hollow blading in a compressor permits boundary layer control to be provided, if this is desired. Since high speed airfoils (laminar flow) are considered very desirable for some compressors, the hollow blade construction becomes of value to provide low weight and high strength, together with adequate stiffness at the trailing edge.

The optimum quantity of bucket cooling air should be ascertained to prevent excessive windage loss consistent with adequate cooling. In certain cases the air may be released from a bucket surface in a manner which affords a reactive or propulsive effect in the direction of rotation to minimize pumping losses. Obviously, the greatest gain from blade cooling accrues at the more highly stressed base. Bucket tips may be permitted to run hot to conserve air since the stress drops to zero at the tip.

(*Turn to page* 103, *please*)

Sheet metal deflectors or ribbed surfaces may be employed inside hollow buckets to increase the effectiveness of blade cooling. A means of assisting the cooling of blade bases and turbine wheel, consists of establishing a downstream flow of excess air from the front side of the wheel, around the outside of the wheel and between the bucket bases.

German Car and Truck Quota

(*Continued from page* 56)

as indicated by increased capitalization of manufacturing firms.

The FEA recommendations, which are only advisory in character and are subject to further policy decisions by the President and Dept. of State, would permit continuance of German automotive capacity sufficient to produce annually 90,000 passenger cars and trucks weighing no more than 2,500 lb. Maintenance and repair facilities would also be permitted.

Distribution of vehicles produced would not be subjected to government control as part of the disarmament program.

Exports of finished vehicles and parts would be prohibited but, under FEA's recommendations, imports of vehicles which cannot be manufactured domestically and which are necessary to the civilian economy would be allowed.

The Committee would permit imports of essential vehicles which would not be produced domestically but would specifically prohibit manufacture of certain parts and subassemblies. However, other manufacturing processes not requiring establishment of a large mechanical industry would be allowed.

It was the unanimous recommendation of the committee that if Germany were permitted to produce quantities of civilian vehicles that can be marketed economically, rigorous measures should be invoked to ensure absence of subsidies or any means of fostering or maintaining unauthorized industrial activity. Should the United Nations policy call for stripping Germany of all or most of her machine tool resources and productive capacity, the report states that the automotive industry should be eliminated. A majority of the Committee, moreover, was of the opinion that the industry should be eliminated in any case.

The minority opinion, according to the report, was that since the industry represented such a small percentage of the machine tool capacity, elimination would be unwarranted as other controls could be invoked to prevent war use. The view was also held that depriving the German population of minimum transport needs would provoke rather than preclude warlike tendencies. Those holding the latter view do not subscribe to the theory that transporta-

(*Turn to page* 104, *please*)

tion equipment can be acquired abroad. Although recognizing the importance of the German automotive in a war effort, there was considerable divergence of views. That is, the dgree to which the industry might prove to be indispensable and the relative effect on Germany's war powers if it were eliminated altogether.

UAP Enters Hydraulic Jack Field

United Aircraft Products, Inc., has entered the hydraulic jack field covering every phase from automotive and utility jacks to aviation, railroad and industrial jacks.

Production is in progress at both the Dayton and Los Angeles plants of a full line of hydraulic jacks for passenger cars, trucks and buses as well as a range of "quick-contact" hydraulic four-wheel jacks for garages, service stations and factories. The "quick-contact" hydraulic jacks are being marketed under the tradename of "Sky High."

Advertising Note

The Eaton Manufacturing Co. of Cleveland has named Florez, Phillips & Clark, of Detroit, as its advertising agency, effective Jan. 1. L. A. Clark, FPC president, is account executive.